

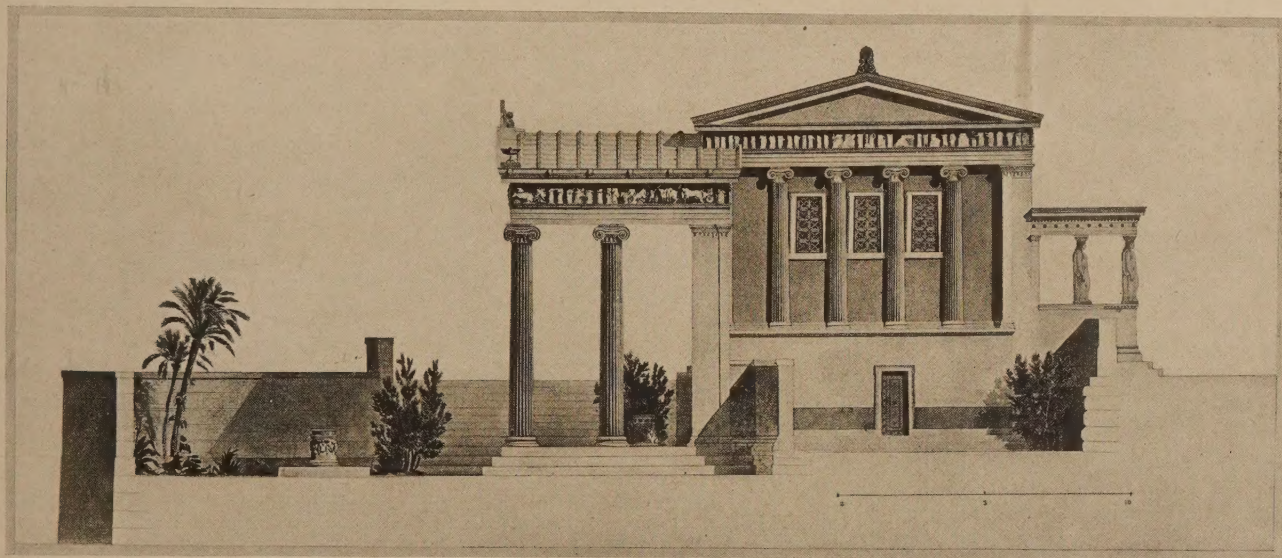
ARCHITECTURE

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No. 2



THE ERECHTHEION.

V. The Classic Orders of Architecture

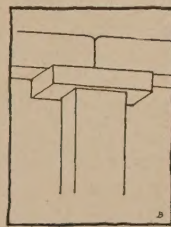
By Egerton Swartwout, F.A.I.A.

THE IONIC ORDER.

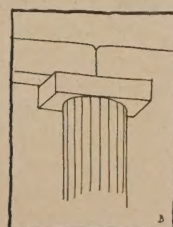
IT has been hereinbefore shown that although precedent has divided the Orders of Architecture into three divisions, still in reality, viewed from the standpoint of structural development, there are only two; the first, a logical and structural development of the principles of support, which is expressed simply in the various forms of Doric, and more elaborately in the Corinthian, and the second an unstructural, purely decorative form, the Ionic. As the name implies, the origin of the Ionic order is to be found in the Asiatic colonies of Greece, and like the Doric it is essentially a Greek order. While it is found in Rome, it never attained there the general popularity that was accorded the Corinthian, the national order of Rome, nor does it owe any of its development to Roman sources. The type which is shown at its height in the columns of the Propylæa was not improved by Roman hands, nor was there in Rome greater development of the decorated form, of which the Erechtheion is the best known example, although a cap of the same general idea but of greater strength and virility, if less delicacy, is to be found in Rome. The four-cornered cap is also of Grecian origin, being foreshadowed in the interior columns at Bassæ, and further developed in some examples

found in Pompeii, which from their character were undoubtedly the work of a Greek architect.

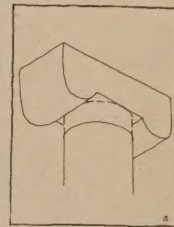
Just as the Doric column and entablature is found to have a wooden origin, so it is possible to trace the Ionic to the same source—the post and the superimposed plate to receive the weight of the beam—the radical differences between the two orders being the development of this plate or cap. In Greece proper this oblong cap was early reduced to a square



I. Original Post and Cap.



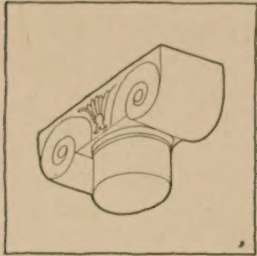
Doric Development.



Ionic Development.

(Fig. I), for the purpose of symmetry, and became a logical

form in stone, as well as in wood, and was developed into the Doric capital. In the colonies, however, it retained its bracket shape, and its ornament and development became so fascinating to the Ionian architect that its structural defects were forgotten and the bracket capital with all its inconsistencies was reproduced in stone because of its beauty. In its early form the corners of the projecting bracket were usually rounded, as



II. Early Cap from Delos.

is attested by some stone remains (Fig. II), and upon this wooden bracket were painted some simple ornaments, of which the spiral was the most appropriate, this form being reminiscent of the curving leaf of a plant, possibly the lotus, or possibly it may be a development of the well-known wave motive which is found in most primitive forms of decoration.

In the translation of the bracket capital into stone the painted ornament was incised, for it is characteristic of the Ionic style that its ornament is carved, whereas the ornament in Doric architecture is painted. These spirals on the early caps were separate for each volute, the ends either turning down, as in the cap of the temple of Appollo at Lesbos or in the Neandrian cap (Figs. III and IV), or finishing horizontally in a half-round, the intervening space being covered with a palmette. The Neandrian cap is interesting as the beam in this case did not rest on the bracket but on an abacus, or block, not wider than the column, showing that the bracket form was kept merely for its beauty, the point of support doubtless being reduced because the greater projection was found unnecessary and at times even dangerous, unless the beam was very accurately bedded. This abacus was always afterwards used, although in the early caps, as in the primitive capital of the first temple of Diana at Ephesus (Fig. V) the abacus retained its great sideways projection over the wide spreading volute; indeed in this cap the bracket form is very apparent, the cap being narrower than the diameter of the column. The development and ornamentation of the face of these brackets was accompanied by a decorative treatment of the sides; the excessive thickness was relieved by channels and grooves cut in the curving surface, and carved palmettes were applied. The echinus, which on the primitive caps was part of the column, became part of the cap, and was gradually partially concealed by the side cushions. The shaft of the column was fluted with very small flutes, sometimes as many as forty-four being found, and there was always a base, either moulded and probably influenced by Persian architecture or sculptured as in the



III. Cap from Temple of Apollo at Lesbos.

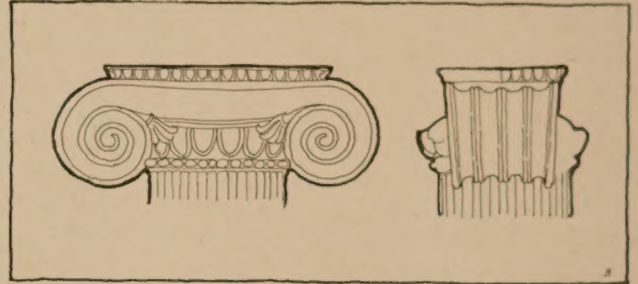


IV. Cap from Neandria.

case of the temple of Diana at Ephesus (Fig. VI).

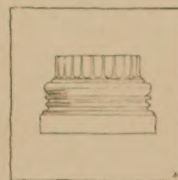
The entablature of the primitive temple was of wood, and consisted of a beam, or rather three beams laid flat, instead of vertically as in Doric work, these horizontal beams being echoed by the breaks in the stone architrave; and directly above

this beam was the cornice, which consisted of the projecting ends of the rafters, on top of which was the usual cymatium or gutter. There was no frieze, and indeed it has been held by some archeologists that even in the later temples in Asia Minor, at Ephesus, Halycarnassus, and elsewhere, no frieze was used, this hypothesis being attested by the rock-cut tombs; and further, that the frieze was an innovation of the Attic Greeks, who, when they adopted the order, introduced the frieze and eliminated the beam ends or dentils. This adoption of the order in Greece itself is most remarkable. With no preliminary gradual development, it suddenly sprang into full bloom, the earliest known examples being the little temple on the Ilissus and the Nike Apteros temple on the Acropolis (Figs.



V. Cap, Original Temple of Diana at Ephesus.

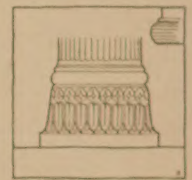
VII and VIII), both a few years in advance of the Parthenon; and while in these temples the proportions are a little clumsy and the volutes too large for the column shaft, still there is shown an immense advance from the Ionian prototype. Why this sudden adoption of a new form, no one knows. Some whim or fancy on the part of a traveled architect, perhaps. An idea has occurred to me, which I cannot advance seriously, nor would I mention it at all, did I not know that a great many points in design really do happen in this way and not by gradual development or from climatic or structural reasons. It is well known that on occasions the shields of victors or heroes were displayed in the temples, and it is conceivable that these shields might at some time have been suspended from the corners of the abacus of a Doric column (Fig. IX). If, as was customary, a garland of leaves or a festoon of flowers was hung between the shields, the resemblance to an Ionic cap would be very appreciable, and the decorative value of this



VI. Ionic Base.



Base Diana at Ephesus.



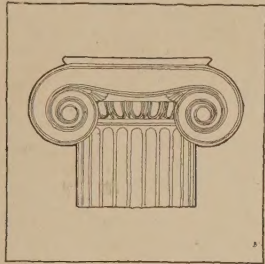
Persian Bases.

form may have appealed to the Greek architect and led to the use and development of the already existing Ionian capital. Whatever was the reason for its adoption, the success of the new order in the Temple of the Wingless Victory and its novel and decorative quality appealed immensely to the Greeks, and Mnesicles, eagerly seizing the idea for the Erechtheion, developed and embellished the order to an extent that has never since been equaled. Also from its slenderness of proportion as well as its beauty the order was used in its simpler form in the Propylaea, and probably in the inner cella of the Parthenon, this comparative slenderness allowing the attainment of greater height than would be otherwise possible without too

great encroachment on the already narrow floor space. The same reason undoubtedly influenced Ictinos to adopt it for the interior order at Bassæ, which has already been referred to as the only really monumental Greek interior.

As has been before suggested, there were three distinct types of the Ionic capital as used in Greece—the simple, the decorated, and the four-cornered or symmetrical. The first or simple type is not only the most usual but is the most natural

form, that is to say natural in its development from the wooden prototype. In its first use in Greece proper, in the little temple on the Ilissus and the temple of Nike Apteros, it was marked by excessive size and projection of the volutes and a certain clumsiness in proportion not only in the shaft but in the entablature. In the Propylæa at Athens (Fig. X), probably built some thirty years later than the temple of Nike



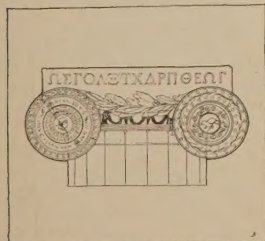
VII. Ilissus Cap.

Apteros, there is a distinct advance in refinement of detail and delicacy of proportions. Unfortunately, this example being in the interior, there was, according to the general Greek rule, no complete entablature, the ceiling beams resting directly upon the top of the cap. We have, therefore, nothing to show what this entablature would have been if the column had been used on the exterior, although it is fair to assume that it would have been generally similar to the entablature of the Niké Apteros temple, undoubtedly with a sculptured frieze and without dentils in the cornice.

From the completion of the Propylæa there is found no further trace of the simple Ionic order in Greece for almost one hundred years, and then it attained its rather full-blown development in the colonies, in the second temple of Diana at Ephesus, Athene Polias at Priene, the mausoleum of Halycarnassus, and the temple of Apollo Didymeus at Miletus (Figs. XI, XII, XIII), and again in Greece proper in the Philipeion at Olympia.

Although these orders all vary considerably in proportion and in detail, the idea is essentially the same. The volutes are simply moulded on the face and are connected by a downward sweep of the fillet which is characteristic of the Greek Ionic, as distinguished from the Roman, this dip in the fillet being undoubtedly for the purpose of counteracting a possible tendency to appear pinched in the centre, if the fillet was continued horizontally.

It also gives a better starting for the volute itself. The rather awkward intersection between the echinus and the volute is usually concealed by a palmette, and a portion at least of this echinus always shows beneath the cushion on the side. The effect of this line is very important and the cap has more of an appearance of homogeneity when not only



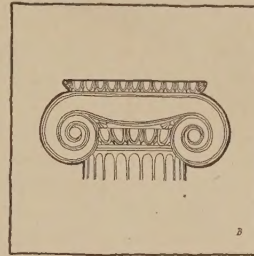
IX. Suggested reason for the adoption of the Ionic Order in Greece proper.

the fillet and bead and reel are visible but also part of the egg and dart course.

There has been much discussion as to how the spiral of the volutes was laid out in classic work. Various methods are

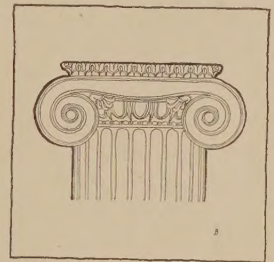
given for obtaining this volute by slightly shifting the centres of the compass, which, although difficult of operation, are generally satisfactory enough, while on the other hand some have imagined that it was obtained by unwinding a string from an inverted cone. Mention is made that on some of the volutes certain marks have been found from which it is conceived that the volutes were struck directly upon the stone from the centres. Personally, from a structural point of view, this method is

absolutely inconceivable. Anyone who has tried to lay out a volute with a compass knows how extremely difficult it is to get any two volutes that are exactly the same, and there is no doubt in my mind that these marks, if caused by compasses at all, were caused by those measuring the cap for the purpose of restoration. I think that unquestionably the Greeks carved their capitals from models,



X. Propylæa Cap.

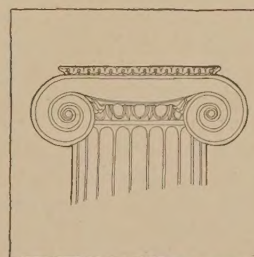
in the Ionic as well as in the Doric, just as is now done, the outline of the volutes being probably pounced in some way similar to the method now in vogue. In modern work I have found it absolutely essential to study the Ionic cap at a small scale in its entirety, in its relation not only to the whole column shaft but to the entablature above. For a height of twenty feet or over, three-quarter scale is plenty large enough to give a very accurate idea of the size of the volute and its projection, as well as the proportion and entasis of the shaft. When the size and position of the volutes have been absolutely determined from the model they can then be laid out mechanically with a compass, following no definite rule, but with the exercise of an enormous amount of patience and by repeated attempts. I have found, however, that it is better to determine the spiral very accurately on the drawing before giving it to the modeler, as a spiral is one of the hardest things to model that I know of. In general, there is no rule for the size or projection of the volutes; it depends entirely upon the material and the character and location of the order, and can only be decided by a careful study from small scale models.



XI. Athene Polias at Priene Cap.

Wherever the Ionic column was used in a peripteral temple in ancient times, the corner column gave the architects endless trouble. In fact, the corner column always presented

a serious problem in any order. In the Doric order it was because of the triglyph, and in the Ionic order because of the fact that the Ionic cap is not four-sided, therefore, in turning the corner it was necessary to put volutes on the two contiguous faces, and in order to do this the corner volute had to be bent outward on the diagonal, while on the interior corner two half-volutes were unsymmetrically joined (Fig. XIV). The result was extremely

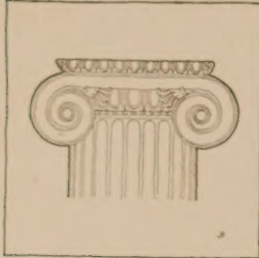


XII. Mausoleum of Halycarnassus Cap.

incongruous and unfortunate, and whereas in the Doric order the problem of the triglyph was successfully solved, in the Ionic order the solution was not to be found, and this not only prevented the most frequent use of the Ionic order in

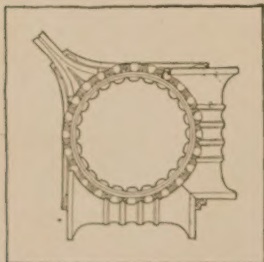
peripteral temples, but even possibly may have prevented its adoption prior to the little temple on the Ilissus. The Romans evidently did not regard the corner volute as a happy solution, and except in a few unimportant instances did not use the Ionic order in peripteral temples.

The second type of cap is the decorated, in which there is not only more elaboration of the volutes themselves, but a further enrichment in the addition of a decorated band or necking between the echinus and the top of the flutes. The only example of this cap in Greece is found in the Erechtheion (Fig. XV), one of the most curious and interesting remains in Greece. It would almost seem that the anthemion ornament used in the necking of the cap and pilasters and in the cymatium of the pediment and of the door formed the key to the whole order,



XIII. Apollo Didymeus at Miletus Cap.

and that in this case, after deciding to use the Ionic order for his temple, Mnesicles conceived the idea of carving in stone the anthemion ornament which up to this time in Greece had been painted, and around this idea evolved the decoration of the cap and of the cornice itself. It is easy to see that the necking of the cap was designed first, and that on account of the very small scale of the anthemion ornament it was necessary to bring down the scale of the volutes and of the flutes as well, consequently the volutes are moulded more richly than in any other order. The abacus is ornamented with a carved egg and dart course, and the cushions at the side of the cap are covered with ornamental beads, placed very closely together; even the base is ornamented. The same desire to bring the whole column into scale with the anthemion ornament and the necking is shown in the narrowness of the arris of the flutes and in the curious half-round moulding applied at the top, this being done to take away the plain space which would otherwise exist between the curved tops of the flutes. The effort to reduce the scale of the cornice was not so successful, although we are so accustomed to the order that we overlook this discrepancy in scale. It certainly seems as if the architrave and the fascia of the cornice are considerably heavier and simpler than would rationally be expected from the decoration and small scale of the column and cap. It may be that there was some painted ornament on the architrave and fascia of the cornice, similar in some respects to that

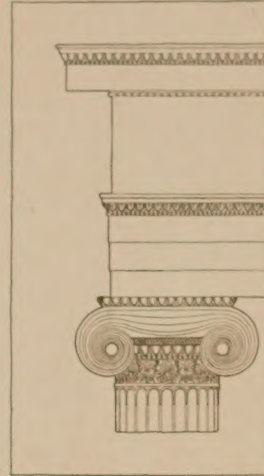


XIV. Plan of Corner Volute. Erechtheion.

shown in restorations of the architrave on the monument of Lysicrates. The frieze was elaborately ornamented with sculpture, which was in white marble, and applied to a backing of dark Elusianian stone. It may be that this was done with an idea of getting a cameo effect, and this has been taken as an indication that no color decoration was used on this temple, and that this means was employed to secure the effect which in the Parthenon and elsewhere was obtained by color. There is, however, extant a report on the condition of the Erechtheion, made during construction on a change of administration, and in the report is an item of the cost of the gold leaf for gilding the eyes of the volutes and a record of certain payments for the encaustic painting of the inner cymatium of the portico. Some painting, therefore, was done, and although no color

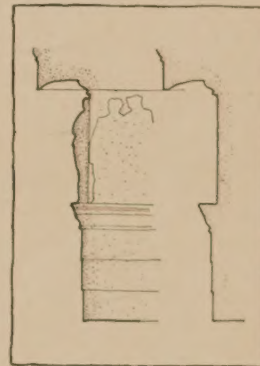
indications have been noted on the architrave, still the suggestion above advanced is by no means impossible.

The face of this frieze to which the sculpture was applied is naturally set back of its normal position, in order to give room for the sculpture, and this position has given rise to some very curious effects in modern times. In many plates showing the Erechtheion the sculptures on the frieze are omitted, and there is shown only the face of the frieze, which serves as a background for the sculpture, and it often happens that in copying this order ruthlessly the modern architect has forgotten or is ignorant of the reason for the position of this frieze face, and it is reproduced just as it shows in the plate, with most unfortunate results (Fig. XVI).



XV. Erechtheion Order.

As has been before remarked, the Attic Greeks always eliminated the dentils which are a prominent feature of the orders in Asia Minor. Presumably this was done from analogy to the Doric order and also because of a feeling that the dentils, by their insistent regularity might interfere with the freely grouped sculpture in the frieze. The cornice, therefore, consisted merely of a decorated bed-mould and a thin, shelf-like corona, which presents to an even more striking degree the



XVI. Frieze of Erechtheion with and without sculpture.

defects previously noted in the Doric cornice, whenever this cornice is used without the white background of the roof tiles above. There are, unfortunately, to be seen many instances in modern work of the use of this order for the lower portion of a large building, where the thinness of the cornice is most unhappy, unsupported as it is by the sculpture below, and emphasized by the unnatural recession of the plain frieze.

In the use of this order in the Erechtheion, there is a curious and interesting example of the method of the Greeks in improving the proportions of their order by comparison with the executed work. Thus in this temple the proportions of the columns in one of the porticoes is much slenderer than



Front



Side.

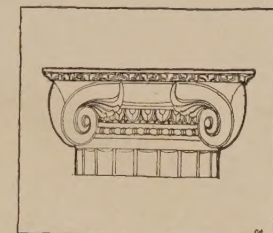
XVII. Cap from the Lateran Museum.

the other, showing unquestionably that they were built at slightly different times, and that an improvement in proportion was sought for in the design of the second portico. It would be interesting to know from the contemporary records

whether the Erechtheion as we now find it is a completed building or only a portion of a larger scheme, and whether the marked irregularities in plan and in level were fortuitously caused by the site and by antecedent conditions, or whether it was a carefully planned effort to obtain an unconventional and picturesque grouping. However it may be, there is no doubt that while the ruins in their present form are eminently picturesque, the result cannot be claimed as a masterpiece of planning, the junction of the lower portico with the side wall being extremely crude. The same crudeness is found in the

like conformation of the interior columns, and the volutes are very cleverly worked out to cover the intersection of the column with the buttressed wall. A peculiarity of this cap is that while perfectly appropriate in the place for which it was designed,

it is not very successful when used for a four-sided cap, the volutes in that case appearing too heavy and seeming to have a too great projection, the intersection of the undersides of the corner volutes being difficult of treatment. It almost seems as if this cap was reminiscent of a metal form, and indeed for a small metal column it is singularly graceful and appropriate.



XIX. Cap from Pompeii

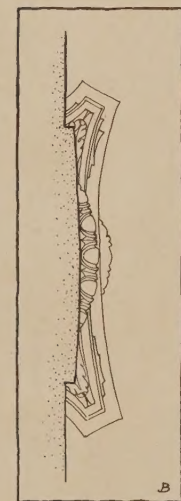
In Rome, or rather in Pompeii, there are several examples of four-cornered caps which, as has already been noticed, are distinctly Greek in character (Fig. XIX). The Romans themselves did not develop this type, probably because of their preference for the Corinthian, but it has been very successfully used by Renaissance architects and also in our own graceful Colonial types.



XX. Denver Post Office Cap.

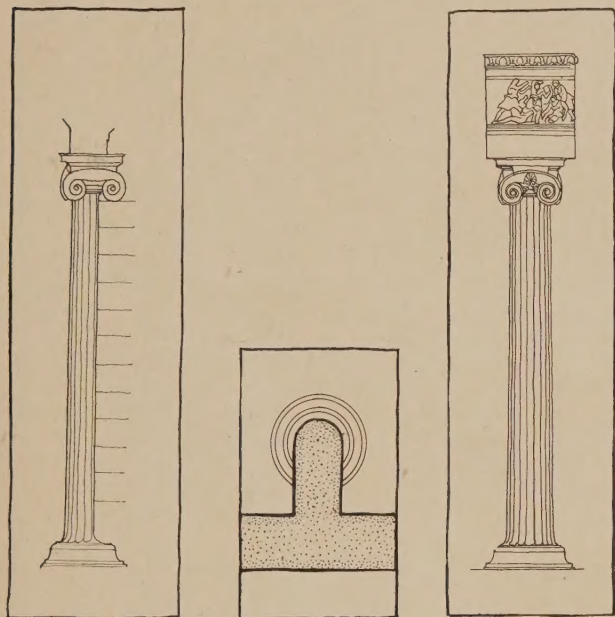
In general, it would seem that although the Ionic is one of the most beautiful of all the orders and most impressive when used in a properly conceived colonnade, yet it is the one order that has been carried to the least degree of perfection in its logical development. The Greeks were just beginning to appreciate the beauties of the Ionic when the decadence of

Greek architecture set in, and the Romans unfortunately never gave it its proper recognition, nor were they interested in its development. In Renaissance and modern times, there have been many attempts and some successful ones to develop it along original lines, but these attempts at best have resulted only in slight modifications of detail. The general principles have remained unchanged. In one of our buildings for the Government a slight variant was used, by making the National coat-of-arms an integral part of the cap, the wings of the eagle forming the curved line connecting the spirals, and these wings being bent forward slightly, give an interesting shadow which emphasizes this dip in the line (Fig. XX). I have also found that when used as a pilaster cap (Fig. XXI), especially if the projection of the pilasters is very slight, the interest of the cap can be increased by giving the volutes a concave curve in plan, this curve contrasting well



XXI. Plan of Pilaster Cap.

with the slightly convex curve of the echinus the abacus naturally in this case following the curve in plan of the volutes.



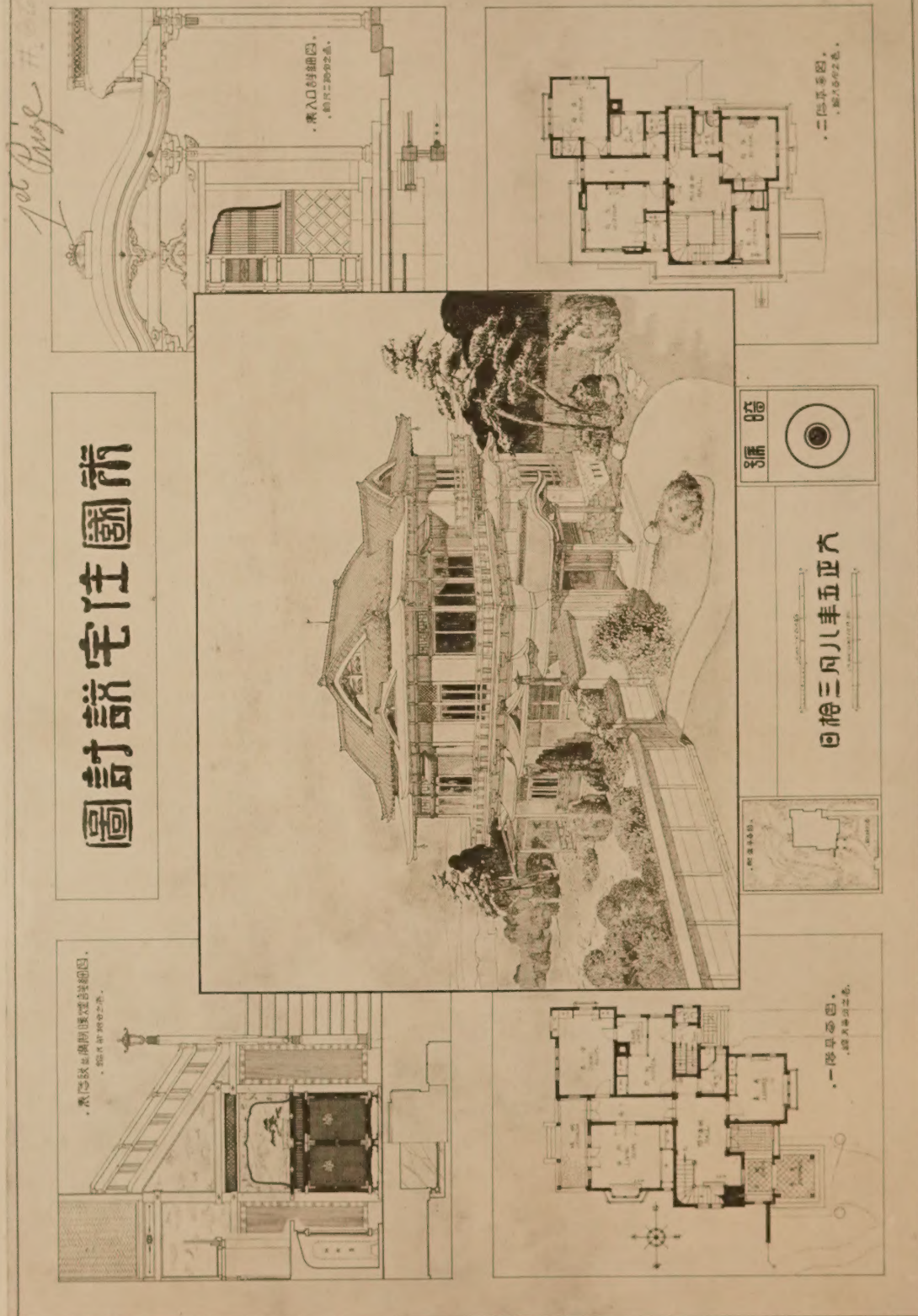
XVIII. Temple of Apollo Epikurios Bassae—Interior order.

Propylæa in the junction of the portico in front of the Pineochea with the wall at the side of the main portico. In point of fact, it does not seem as if the art of planning had ever been either recognized or developed among the Greeks as it was by the Romans. Building their temples practically upon one simple plan, they seemed to lavish all their care and attention upon the exterior, the temple lacking that monumental quality of interior and surroundings which is necessary to a perfect work of art.

Another remarkable and interesting type of the decorated Ionic is found in a fragmentary capital in the Lateran Museum at Rome. It also had a decorated necking (Fig. XVII), but with a more virile treatment than that of the Erechtheion. The spiral of the volutes has a forward projection which is extremely vigorous, and the junction of the echinus and the volute is handled in a most interesting manner.

The third type of Ionic cap is the four-cornered or symmetrical, which is interestingly shown in the capitals of the interior columns at Bassae (Fig. XVIII). Here, unquestionably, this type was forced upon the architect by the peculiar buttress-

市國住宅設計圖

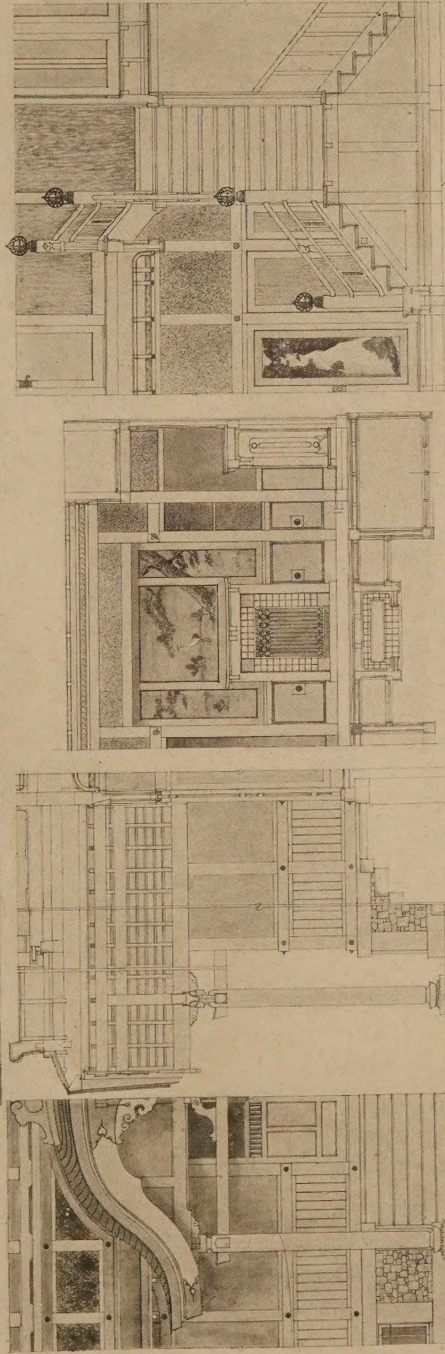
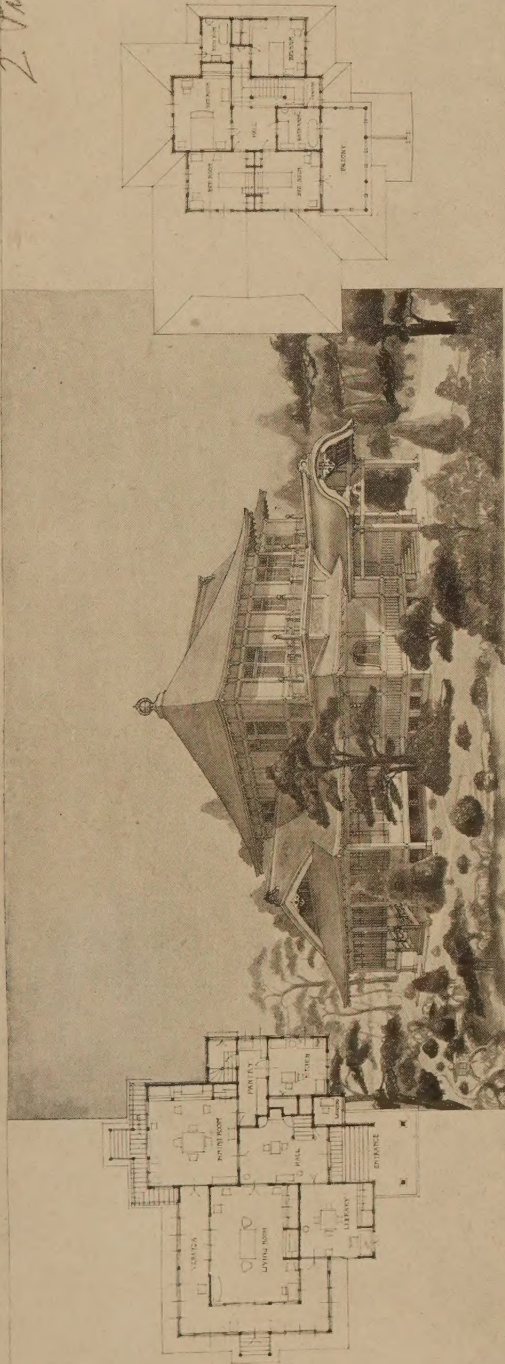


YAMANAKA COMPETITION. FIRST PRIZE DESIGN.

The competition was open for young architects and draftsmen in Japan, to show adaptability of Japanese architecture to a suburban house in America, costing not more than \$20,000.

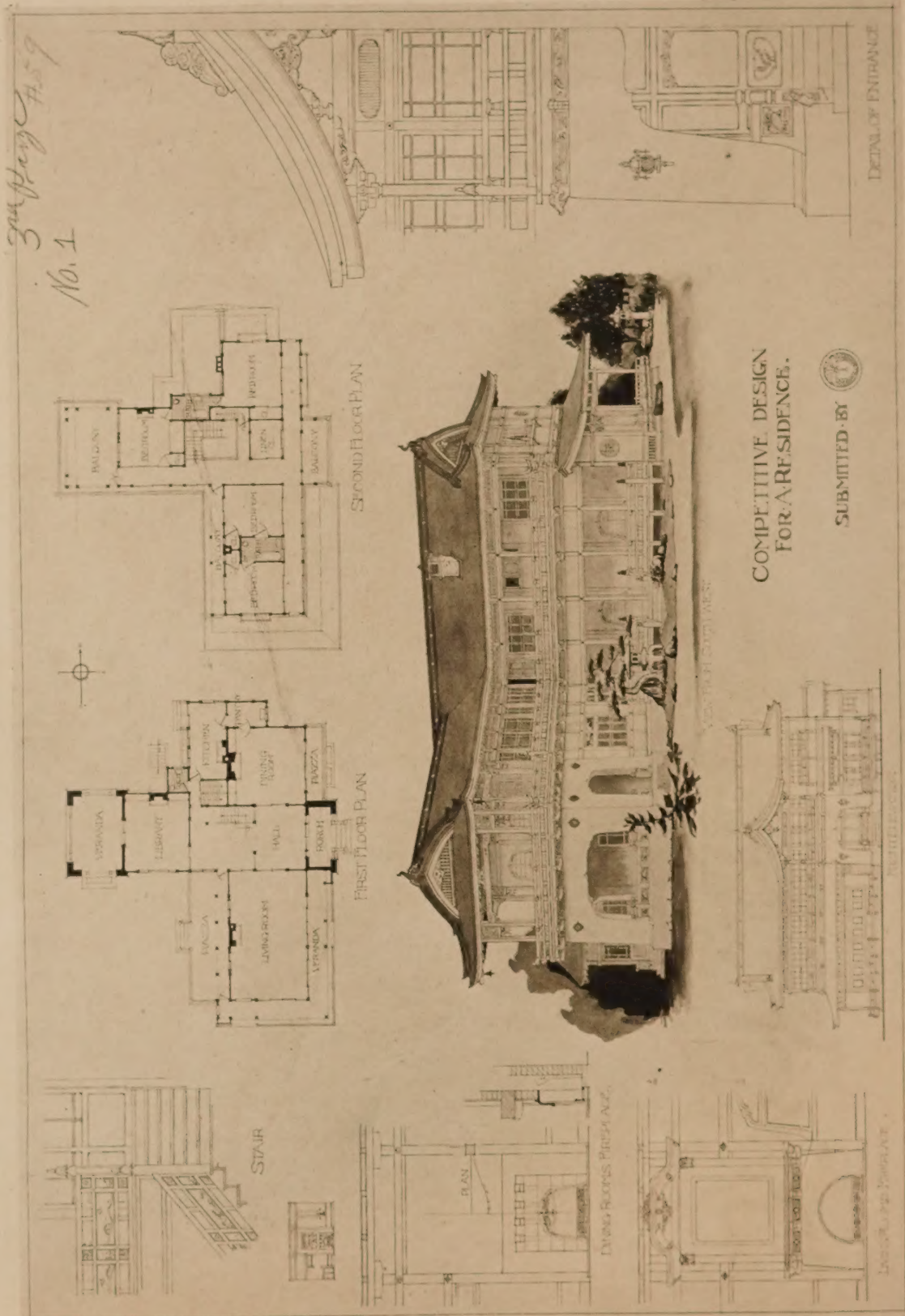
Submitted by Iwao Shimizu, Tokio, Japan.

2nd Prize 1904



YAMANAKA COMPETITION. SECOND PRIZE DESIGN.

Submitted by Yoshio Tamura, Tokio, Japan.
This competition was open for young architects and draftsmen in Japan, to show adaptability of Japanese architecture to a suburban house in America, costing not more than \$20,000.

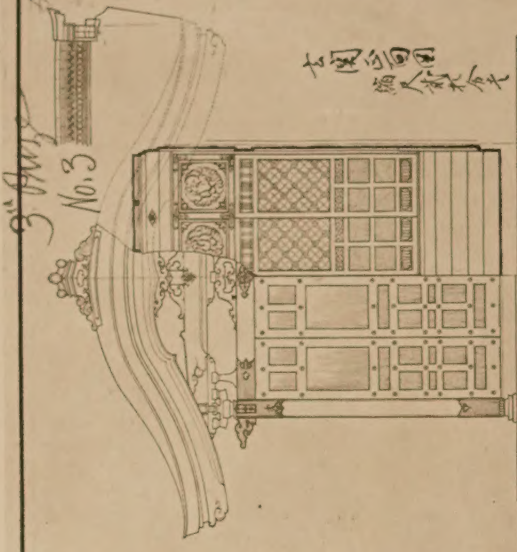


YAMANAKA COMPETITION, THIRD PRIZE, NO. 1 DESIGN.

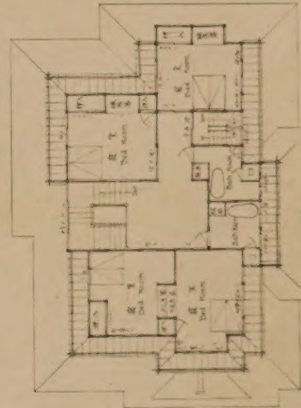
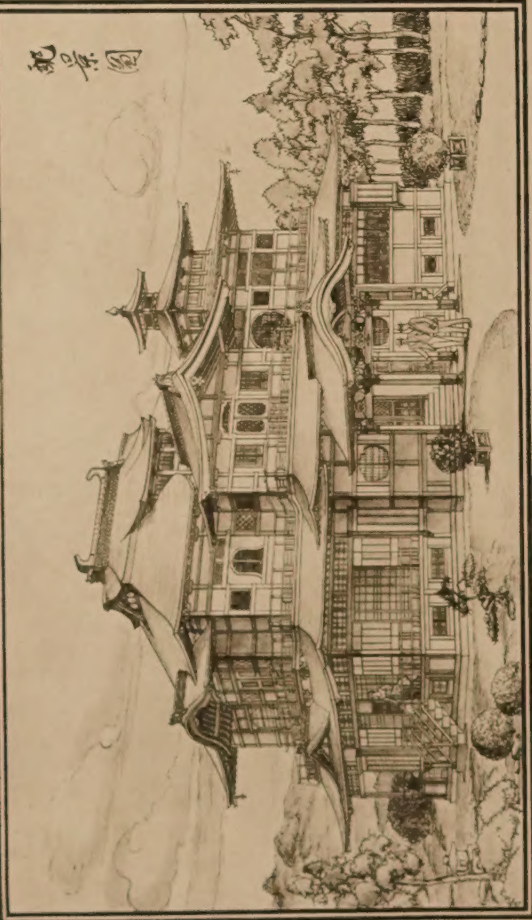
This competition was open for young architects and draftsmen in Japan, to show adaptability of Japanese architecture to a suburban house in America, costing not more than \$20,000.

Submitted by Koichi Kuroda, Tokio, Japan.

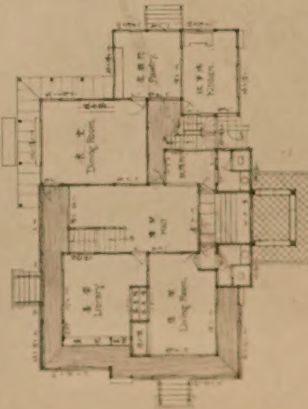
米國住宅設計圖



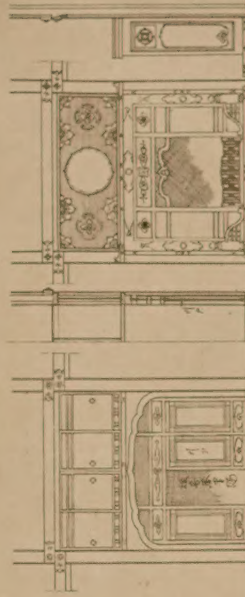
配景圖



第二層平面圖
第二層



第一層平面圖
第一層



左側面

右側面

背面及書院暖火戶面圖
背面



正面及書院暖火戶面圖
正面

YAMANAKA COMPETITION. THIRD PRIZE, NO. 3 DESIGN.
This competition was open for young architects and draftsmen in Japan, to show adaptability of Japanese architecture to a suburban house in America, costing not more than \$20,000.

Submitted by Kichigoro Kamiya, Tokio, Japan.

The Yamanaka Competition

PROGRAM: To design a suburban house in Japanese style costing not more than \$20,000.

PRIZES: First, 300 yen; second, 150 yen; third, 50 yen; fourth, 50 yen; fifth, 50 yen.

This competition is open to young architects and draughtsmen in Japan, to show adaptability of Japanese architecture to a suburban house in America.

SITE: Assumed to be in the suburbs of New York City. Size of lot 100 x 150 feet between highway and a large river; 100 feet on the east faces road, and on the west uninterrupted view. Ground is practically level.

GENERAL: House will be two stories, attic, and portion excavated for basement. The style must be Japanese, both in exterior and interior. Materials are optional, but no matting to be used for floors. Care must be taken for heating, ventilation and all conveniences an American house has. The cubic contents must not exceed 65,000 cubic feet.

REQUIREMENTS: First floor—Living room, dining room, library, kitchen and pantry.

Second floor—Four bed chambers, each with closet; two bath rooms.

Attic floor—For storage only.

Basement—Laundry and heating apparatus.

DRAWINGS: It is required to show $\frac{1}{8}$ " scale plan of first and second floors; $\frac{1}{4}$ " scale perspective of exterior, and $\frac{5}{8}$ " scale (1/20 of actual size) details of main entrance, staircase and a fire place.

PRESENTATION: All drawings to be on one sheet, rendered in pen and ink, or monotone. Size of this sheet is to be exactly 25" x 37" (Whatman paper or equivalent) with single line border $\frac{1}{2}$ " from edges. Each competitor is to sign only a nom-de-plume, or device, on the drawing. Each competitor's true name and address is to be clearly printed on a card enclosed in a sealed, opaque envelope, pasted on the back of drawing, the nom-de-plume being repeated on the outside of the envelope.

TIME: This competition will be closed in Japan August 31st, and in New York City October 15th.

DELIVERY OF DRAWINGS: The drawings are to be enclosed in a strong tube, less than 3" diameter, securely wrapped and addressed to Yamanaka Gallery, 254 Fifth Ave., New York City, N. Y., U. S. A.

JURY OF AWARD: Mr. Arthur Ware, New York; Mr. Henry Killam Murphy, New York; Mr. John VanPelt, New York; Dr. Jokichi Takamine, New York; Mr. D. Ushikubo, New York; Mr. Iwahiko Tsuma-Numa, New York.

Drawings submitted in this competition are at owner's risk from time sent until returned, although reasonable care will be exercised in their handling and keeping.

The prize drawings are to become the property of the Yamanaka Gallery; and the right is reserved by the Yamanaka Gallery to publish or exhibit any or all of other drawings submitted.

This competition was planned by Mr. Daijiro Ushikubo, manager of Yamanaka & Co., New York, and the programme was written by Iwahiko Tsuma-Numa.

There were forty-one designs submitted, which were judged on December 28, 1916, at the Nippon Club. Mr. Arthur Ware, of New York; Mr. Henry Killam Murphy, New York; Mr. John Van Pelt, New York; Mr. Daijiro Ushikubo, New York, Mr. Tetsuro Nakae, Japan, and Iwahiko Tsuma-Numa, New York, served as jury of award. Mr. T. Nakae was substitute in the place of Dr. Jokichi Takamine.

Remarks were made by jury as follows:

The First Prize Design shows the real Japanese architecture in every respect, and expresses a dignified and attractive type of residence. Details are distinctive and original, and show careful study of the conditions in this country. Plans are good, but could be much improved without changing elevations.

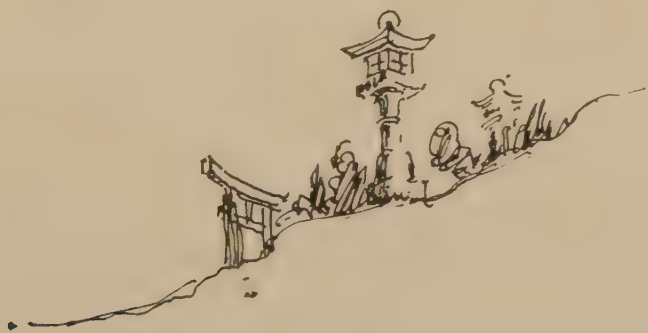
Second Prize Design shows a charming and attractive elevation, and expresses the atmosphere of a private residence. Details are excellent. Plans are compact and carefully arranged. Porches all around living room is a typical Japanese arrangement, but would not be desirable in America. The mistake in staircase detail counted strongly against this design in the award.

Third Prize Design, No. 1. All the American architects liked the elevation in this design, which is of imposing and dignified character; this house would be well suited for the conditions of this country, but lacks the expression of a private dwelling. Details are fairly good.

Third Prize Design, No. 2, shows carefully thought-out elevation, plan and details, but is too much of mixed Japanese and European architecture.

Third Prize Design, No. 3, shows too complicated a roof, making the house resemble a restaurant or place of amusement. Plans are very good, and show a real knowledge of American requirements. The excellence of the details, if the elevation had been simpler, would have entitled the competitor to better than fifth place.

The general average of designs submitted in this competition is very high, considering that very few of the competitors had ever been in this country, and indicate the interest felt by the Japanese in studying American architecture.



XX. Engineering for Architects

By DeWitt Clinton Pond, M. A.

Mr. Pond has charge of the practical course in Architectural Engineering at Columbia University. He is the author of "Engineering for Architects" recently published in book form. This series, started in July, 1916 ARCHITECTURE, is a continuation of the previous series concluded in the issue of June, 1915.

IN previous discussions the design of beams and girders for the support of floor loads was investigated and it is natural that this method of supporting floors should first be examined because of its similarity to steel construction. A newer type of floor support is found in the design of reinforced concrete flat slabs and, although no reference is made to this design in the New York Building Code, there has been a ruling on this subject by the Commissioner of Buildings of Chicago, dated August 18, 1914, which is both comprehensive and condensed. The design described in this article will be in accordance with what has been found acceptable in New York, but reference will be made throughout to the Chicago ruling.

In this flat slabs are defined as follows: "Flat slabs are reinforced concrete slabs supported directly by reinforced columns, with or without plates or capitals at the top, the whole construction being hingeless and monolithic without visible beams or girders. The construction may be such as to admit the use of hollow panels in the ceiling or smooth ceiling with depressed panels in the floor." In other words, this type of floor construction may be regarded as simply a flat, rectangular reinforced concrete slab, supported at four corners by columns. Probably no such simple type of flat slab is in existence, as a floor area that could be supported by four columns would be too small to be practical, and where there are a number of columns used to support a floor or roof the slabs adjoining one another act to make the design of the slabs correspond to the design of continuous beams, with negative bending over the supports and positive bending between the columns.

Again referring to the ruling, the minimum thickness (t) of the slab is given as .023 multiplied by the panel length in feet (L) and by the square root of the total live and dead load in pounds per square foot (w). $t = .023 \times L \times \sqrt{w}$. Also the ruling states that "in no case shall the slab thickness be less than one thirty-secondth ($1/32$) of the panel length for floors, and one-fortieth ($1/40$) of the panel length for roofs, and also not less than six inches (6")."

The "panel length" is defined "as the distance from center to center of columns of the side of a square panel, or the average distance from center to center of columns of the long and short sides of a rectangular panel," or, in other words, suppose there were a square panel measuring 20 feet by 20 feet, then the "panel length" would be 20 feet, but if a panel measured 18 feet by 20 feet then the panel length would be the average distance or $(18 + 20) \div 2 = 19$ feet. In another paragraph of the ruling the statement is made that in no rectangular panel shall the length exceed four-thirds ($4/3$) of the breadth. No panel can measure 15 feet by 21 feet as the greatest length that such panel could have would be $4/3 \times 15 = 20$ feet.

To recapitulate: if the panel measured 18 feet by 20 feet the panel length would be 19 feet. Such a panel is shown in Fig. 107. If it is assumed that the live load is 125 pounds per square foot, and that the dead load is 87 pounds, then the "total live and dead load in pounds per square foot" will be $125 + 87 = 212$ pounds, and substituting in the formula

given above it can be found that t , the slab thickness, will equal $.023 \times 19 \times \sqrt{212} = 6.35$ inches.

This thickness is more than six inches, which is one of the requirements, but it is also necessary to apply another test, namely, that the thickness of the slab shall not be less than

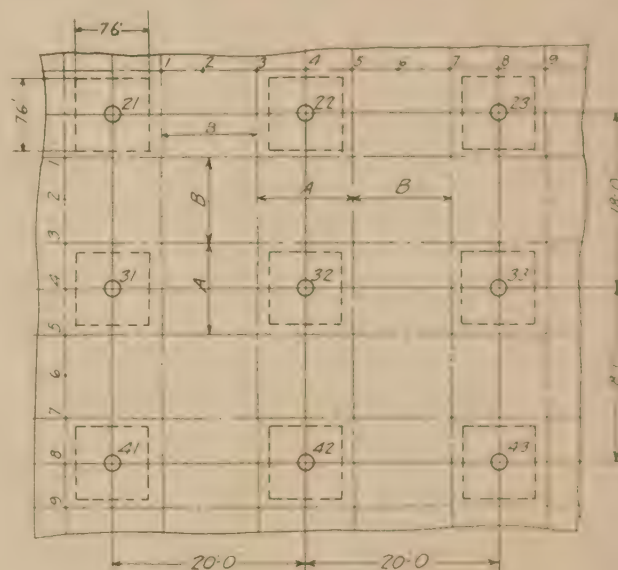


FIGURE 107

one-thirty-secondth of the panel length. $1/32 \times 19 \times 12 = 7\frac{1}{8}$ inches. As this thickness is greater than the one found above, it will be the one selected.

In order to have this article follow in a general way the items set forth in the ruling, the next thing to be discussed will be the least diameter of the columns. With regard to this the ruling establishes the least diameter—or least dimension—as one-twelfth of the clear height of the column, or one-twelfth of the panel length. One-twelfth of the particular panel length under discussion will be $(19 \times 12) \div 12 = 19$ inches. As the thickness of slab has been found to be $7\frac{1}{8}$ inches, and as 3 inches must be added for the depth of the drop panel—to be explained later—the approximate thickness of slab and drop panel over the column will be 10 inches. If the clear story height from floor to floor is taken as 12 feet, the clear height of column will be 11 feet and 2 inches, or 134 inches. One-twelfth of this will be $134 \times 1/12 = 11\frac{1}{6}$ inches which is less than 19 inches found above. The least dimension of the columns will be, therefore, 19 inches.

Although the definition of a flat slab states that it may be supported directly on reinforced columns *with or without* plates or capitals, it is always customary to have a capital for each column, and this is defined as "the gradual flaring out of the top of the column without any marked offset." An

elevation of a typical column is shown in Fig. 108. The capital has a diameter which "shall be measured where its vertical thickness is at least one and one-half inches ($1\frac{1}{2}$ ") and this diameter shall be at least two hundred and twenty-five thousandths (.225) of the panel length." In the present case this diameter must equal $.225 \times 19 = 4.27$ feet, or 4 feet and 3 inches approximately. The

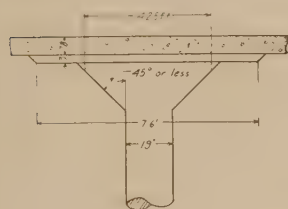


FIGURE 108

slope of the capital must not be more than 45 degrees with the vertical, as shown.

Above the capital is what is known as the "drop panel" which is square in plan, with its thickness determined by the tendency toward bending, and its plan dimensions determined

by the tendency toward shearing. The thickness will be considered first, and in order to check this it will be necessary to find the tendency toward bending that exists directly over the point of support at the center line of the column. To find this it will be essential to understand the method employed to divide the floor area into strips, called panel strips, which are used for the purpose of determining the bending moments in the floor.

The ruling has this to say on the subject: "For the purpose of establishing the bending moments and the resisting moments of a *square panel*, the panel shall be divided into strips known as strip A and strip B. Strip A shall include the reinforcement and slab in a width extending from the center line of the columns for a distance each side of this center line equal to one-quarter ($\frac{1}{4}$) of a panel length. Strip B shall include the reinforcement and slab in the half width remaining in the center of the panel. At right angles to these strips the panel shall be divided into similar strips A and B, having the same widths and relations to the center line of the columns as the above strips. These strips shall be for designing purposes only, and are not intended as boundary lines of any bands of steel used." The same method is applied to a rectangular panel.

Referring to Fig. 107 it will be noticed that the distance between column 21 and column 22 is divided into four parts. The distance between column 22 and column 23 is also divided into four parts. Through points 1, 3, 5, 7 and 9 vertical lines are drawn and between the lines through 3 and 5, and 7 and 9 strips are formed and each one is designated by the letter A. Between 1 and 3, and 5 and 7 other strips are formed which are designated as strips B. In like manner the distances between columns 21 and 31, and between columns 31 and 41 are divided into four parts and through the one-fourth points horizontal lines are drawn forming strips A over the columns and strips B between the columns. A rectangle is formed by the intersection of these strips directly over each column, and these rectangles are where strips A cross each other. The rectangle in the center of each panel is where strips B cross each other. All the other rectangles are formed by an A strip crossing a B strip.

These strips are used for the purpose of finding the bending moments in the concrete only, and the method of finding these moments is given in this manner in the ruling. "The negative bending moment taken at a cross section of each strip A at the edge of a column capital or over it, shall be taken as $WL^2 \div 15$. The positive bending moment at a cross section of each strip A, mid-way between column centers, shall be taken as $WL^2 \div 30$. The positive bending moment taken at a cross section of each strip B, in the middle of the panel, shall be taken as $WL^2 \div 60$. The negative bending moment,

taken at a cross section of each strip B, on the center line of the columns shall be taken as $WL^2 \div 60$. In the formulas herein above given

W = total live and dead load per lineal foot of each strip.

L = panel length in feet."

To apply the above reasoning to the present case, the panel length has been found to be 19 feet. One-half of this length will be 9.5 feet, which is the width of each strip A, and each strip B. It has been established that the total live and dead load per square foot of floor area is 212 pounds. So the total live and dead load *per lineal foot of each strip* will be $9.5 \times 212 = 2,014$ pounds. This is W. L has been established as 19 feet, so the negative bending directly over the column will equal $WL^2 \div 15 = (2,014 \times 19 \times 19) \div 15 = 48,470$ foot-pounds, or $48,470 \times 12 = 581,640$ inch-pounds. If the formula is used for finding the moment in the center of the span for each A strip, the bending moment will be one-half of the one found above, or 290,820 inch-pounds, and this is a positive moment, the tendency toward bending being in the opposite direction from that over the column. These are the only moments to be accounted for in the A strips. It will be noticed that the negative and positive moments in the B strips are the same and are equal to one-half the positive moment established for the A strips, or may be found by using the formula $M = 1/60 WL^2$. The positive bending moment that has been found for the A strip is 290,820 inch-pounds. One-half of this is 145,410 inch-pounds. This may be checked by the use of the formula. $M = 1/60 \times 2,014 \times 19 \times 19 = 12,120$ foot-pounds, or $12,120 \times 12 = 145,440$ inch-pounds, which checks fairly well with the moment already found.

These moments are found for what is known as "two-way" reinforcing and this name is applied to "the system of reinforcement in which the reinforcing bars are placed parallel and at right angles to the center lines of the columns." Another system, known as the four-way system of reinforcing, has the bars placed at right angles and parallel to the center lines of the columns, and also, diagonally. More will be said about this later. For the present the two-way system will be investigated.

According to acceptable New York practice the drop panel is never made less than 3 inches deeper than the slab. The slab was found to be $7\frac{1}{8}$ inches thick and the drop panel cannot be less than $10\frac{1}{8}$ inches thick. This thickness is designated by t and is the total thickness of the concrete. The depth from the top of the slab to the steel is designated by d and is about $1\frac{1}{4}$ inches less than t . A method, however, of checking the depth must be employed in order to find the compressive stress in the concrete. It will be necessary to assume the dimensions of the drop panel and for this purpose it will be considered to be a square with a side equal to $.4 \times L$, or four-tenths of the panel length. $.4 \times 19 = 7.6$ feet or 7 feet and 7 inches approximately. This will be considered as the width of the beam.

The maximum negative bending moment was found to be 581,640 inch-pounds. The stress in the steel will be given by the formula $M = S \times \frac{7}{8} d$. d in this case is $10\frac{1}{8} - 1\frac{1}{4} = 8\frac{7}{8}$ inches. $581,640 = S \times \frac{7}{8} \times 8\frac{7}{8}$. $S = 581,640 \times 8/7 \div 8\frac{7}{8} = 74,900$ pounds, and this is the total stress in the steel. This must equal or be less than the total allowable stress in the concrete if the slab is to be considered safe. In the first article of this series the statement was made that the stress in either the steel or concrete equals 1,462.5 multiplied by the depth, for a slab 12 inches wide. If this is true then 74,900 pounds, which is the stress in the steel, and consequently in the concrete, must equal $7.6 \times 8,875 \times 1,462.5$. But this last multiplication will result in 98,600 pounds, which is the allow-

able stress in the concrete, and as this is considerably more than the existing stress, the concrete is safe as far as compression is concerned. The depth is greater than necessary.

The stress in the centre of the span, between two columns, is found in the same manner as that over the supports, and equals 56,500 pounds. The compression in the concrete for this condition should also be checked and the only difference between this and the problem given above is that the depth is less. In this case it is only $5\frac{7}{8}$ inches, and for the purposes of checking it will be considered as simply 6 inches, and, as the moment is taken in the center of the span, the width will be 9.5 feet. $C = 9.5 \times 6 \times 1,462.5$. This will give the allowable compression in the concrete as 83,400 pounds, which is larger than the actual compression. The constant, 1,462.5, used above, is determined on the basis that the maximum allowable extreme fibre stress in the concrete is 650 pounds. In Chicago this constant would be greater, as the extreme compressive stress in the concrete is 700 pounds, and the constant becomes $700/2 \times 12 \times \frac{3}{8} \times d = 1,575d$.

The thickness of the drop panel having been assumed, according to practice, as equal to $10\frac{1}{8}$ inches, and as this depth has been found to be safe, the next item to be checked is the shear at the edges of the drop panel, and at the circumferences of the capital. The drop panel was assumed to be 7.6 feet square, and the distance around it will be $7.6 \times 4 = 30.4$ feet, or 364.8 inches. If the total shear is divided by this distance multiplied by seven-eighths of the depth, the actual shear per square inch in the concrete will be found. The total shear can be found in the following manner:

The column may be considered as supporting a panel measuring 18 feet by 20 feet, and having an area of 360 square feet. The load per square foot on this area has been determined as 212 pounds, so the total load on the panel will be $212 \times 360 = 76,300$ pounds. Now the floor area may shear off the column as though the column, capital, and the drop panel were punched up through it, leaving a square hole of the shape and size of the drop panel. In this case the floor load directly over the drop panel would cause no tendency toward shear. This load is equal to $7.6 \times 7.6 \times 212 = 12,245$ pounds, and if this is subtracted from 76,300 pounds the remainder is 64,055 pounds of total shearing force, that will tend to push the floor panel down past the drop panel. As has been stated $64,055 \div (364.8 \times \frac{7}{8} \times 5\frac{7}{8})$ will give the actual shearing stress per square inch on the concrete, and this will be found to be 18.8 pounds.

The ruling has this to say about the allowable shear per square inch: "The allowable unit shear on the perimeter of the drop panel shall be three one-hundredths ($3/100$) of the ultimate compressive strength of concrete." The Chicago Code allows an ultimate compressive strength of concrete of 2,000 pounds per square inch. Three one-hundredths of 2,000 is 60 pounds per square inch, which is allowed as the shearing value of concrete around the perimeter of the drop panel. As the actual shearing stress per square inch was found to be only 18.8 pounds, the drop panel is even larger than necessary. If the architect cares to investigate the matter further he may find the exact length of the drop panel side which will be large enough to give a safe shearing value, but not too large as it is the side in the present case.

Another tendency toward shearing may be investigated. The floor area may shear off as though the column and capital were punched through the drop panel and floor slab, leaving a circular hole having a diameter equal to the diameter of the capital. This diameter has been found to be 4 feet and 3 inches, or 51 inches, and the circumference is $51 \times 3.1416 = 160.2$ inches. The area is $(4.25)^2 \times 3.1416 \times \frac{1}{4} = 14.18$

square feet. The load directly over the column capital, which causes no tendency toward shearing, is $14.18 \times 212 = 3,000$ pounds. If this is deducted from 76,300 pounds, the total shear on the circumference of the capital will be 73,300 pounds. Divide this by the circumference multiplied by seven-eighths of the depth, and the shear per square inch will be found. $73,300 \div (160.2 \times \frac{7}{8} \times 8\frac{7}{8}) = 59.0$ pounds per square inch actual shear.

According to the ruling the allowable shear per square inch is given as three-fiftieths ($3/50$) of the ultimate compressive strength of concrete, or $3/50 \times 2,000 = 120$ pounds per square inch. As this is much larger than the actual shear, the thickness of the concrete above the capital is more than great enough.

The only other item that may cause confusion is the method of determining the proportion of steel to be placed parallel to the long or short dimension of the panel. It is obvious that if the panel is absolutely square there will be no difference in the manner of placing the steel in either direction. According to the ruling, "when the length of a panel does not exceed the breadth by more than five per cent. (5%), all computations shall be made on the basis of a square panel with sides equal to the mean of the length and breadth." If the panel is square, or if the length is not more than five per cent. of the breadth, the area of steel is the same in either direction.

To follow the ruling a little further, "for panels with length more than five per cent. in excess of the breadth, the slab shall be designed for a bending moment based on an assumed square panel with the sides equal to the mean length and breadth of the rectangular panel." This has been explained already, and the bending moments have been found. These were 581,640 inch-pounds, 290,820 inch-pounds, and 145,400 inch-pounds for the positive bending in A strips, the negative bending in A strips, and the positive and negative bending in B strips.

The stresses in the steel caused by these moments will be 74,900 pounds, 56,500 pounds, and 28,250 pounds. The area of the steel, in the A strip, over the support will be $74,900 \div 16,000 = 4.67$ square inches. The area of steel needed in the center of the span will be $56,500 \div 16,000 = 3.54$ square inches, and the area needed in the B strips will be one half of this or 1.77 square inches.

Now it is obvious that there will be more steel needed in the long span—20 feet—than in the short span—18 feet. The method of finding the area of steel in the long span is to multiply the area already found by the cube of the ratio of the actual span to the assumed span. The actual span is 20 feet. The assumed span is 19 feet. The cube of the ratio of the first to the second is $(20 \times 20 \times 20) \div (19 \times 19 \times 19) = 1.166$. If the areas found above are multiplied by this figure the areas for the long span will be obtained.

The same method is employed for the short span. The actual span is 18 feet. The assumed span is 19 feet. The cube of the ratio of the first to the second is $(18 \times 18 \times 18) \div (19 \times 19 \times 19) = .85$ and if the areas are multiplied by this figure the amounts of steel needed for the short span are found.

There are other items discussed in the Chicago ruling which it is impossible to take up in this article. The four-way system of reinforcing is described and if the ruling is followed and the methods employed that are outlined in this article there should be no difficulty experienced in designing steel for this method of reinforcing.

The shearing values given above are taken from the Chicago code. In New York the shearing value for concrete alone is 40 pounds per square inch, and for reinforced concrete is 150 pounds per square inch. These values should be borne in mind in case the design is made in New York.

Legal Decisions of Interest to the Architect

These decisions appear monthly and are edited by Mr. John Simpson, the well-known lawyer.

ACQUIESCENCE IN BREACH OF CONTRACT.

In an action to recover for breach of contract in failing to furnish terra cotta trim for plaintiff's building, the New York Appellate Division held the evidence sufficient to take to the jury the question whether defendant refused to proceed with the work unless paid more money than agreed, and falsely stated that the original contract had been canceled by the plaintiff's architect, constituting an anticipatory breach of the contract. Assuming that the defendant breached its contract to supply terra cotta trim for plaintiff's building, the fact that plaintiff did not act upon such breach and order terra cotta elsewhere, but negotiated with defendant for a new contract, was not an acquiescence in such breach, where such action on plaintiff's part was induced by defendant's false statement that the original contract had been canceled by plaintiff's architect, which statement plaintiff believed and relied upon.—*Sherry vs. Federal Terra Cotta Co.*, 158 N. Y. Supp. 241.

ARCHITECT'S AUTHORITY TO ORDER EXTRA WORK.

In an action by a subcontractor against an owner to recover the costs of certain extra work alleged to have been ordered by the defendant's architect, there was no evidence of direct or actual authority in the architect to give the order, and the plaintiff relied upon an apparent authority. The defendant denied that the architect had any authority. This was corroborated by the testimony of the architect and one other witness, and this was supplemented by the fact that in two other instances of departure from the specifications the plaintiff required previous written authorization of the architect to do the extra work, and further by the fact that when the work was done the building had been leased to a third party on whose account, according to the architect, the extra work had been ordered. The Pennsylvania Superior Court held that the case was for the jury, and verdict and judgment for the defendant were sustained.—*Cates & Shepard v. Seltzer*, 62 Pa. Super. 348.

ACTS OF INDEPENDENT CONTRACTORS.

In an action against the owner of premises on which a building was being erected, for personal injuries caused by the fall of a fence, it appeared that none of the provisions of the building contract gave the owner or his architects any right to control the contractors as to the methods of work, the power of direction given to the architects relating only to the character of material and workmanship used. It was held by the Texas Court of Civil Appeals that the contractors were "independent contractors," and the owner was not liable for injuries caused by their negligence. Nor was the owner liable on the ground that the building and maintenance of the fence were incident to the work and not authorized by law. The contract did not require the construction of the fence, which was built by the contractors in the street to keep people off the premises. The owner could not have required them to erect the fence, and it was not erected under agreement with him, nor was its erection authorized by him.—*Ewing vs. Litzmann* (Tex.), 188 S. W. 742.

ASSIGNMENT OF PROGRESS PAYMENT BY PUBLIC CONTRACTOR.

The Supreme Court of the United States holds that an assignment of a progress payment for work done under a contract for a public improvement is valid—the municipality not

objecting—as against any rights of a sub-contractor who thereafter served notice on the municipality to withhold payment, as permitted by the California Code of Civil Procedure, although such assignment did not receive the consent of the board of public works, and the contract expressly provided that without such consent the contractor shall not "either legally or equitably assign any of the moneys payable under the contract or his claim thereto." The decree of the Circuit Court of Appeals (211 Fed. 561, 215 Fed. 81), was therefore reversed.—*Portuguese American Bank of San Francisco v. Welles*, 37 Sup. Ct. Rep. 3.

EFFECT OF BOND ON MECHANIC'S LIENS.

A contract entered into by a board of education for building a schoolhouse required the contractor to give a bond for its faithful performance, and also a bond for indemnity against mechanics' liens in accordance with the statute. The same surety company executed both bonds. That for faithful performance made liability thereunder contingent upon certain conditions which were not referred to in the other bond. Several lien statements were filed. The surety company procured assignments from the claimants on the ground that the conditions referred to had not been complied with. The Kansas Supreme Court held that as the statute provides that no lien shall attach where a bond such as it describes is given for the payment of claims that might be a basis of liens, the giving of such a bond prevented a lien from attaching, irrespective of any failure of the board to comply with the terms of the other bond.—*Southern Surety Co. v. Hudson* (Kan.), 160 Pac. 209.

LIABILITY FOR INJURIES TO TRESPASSERS.

A workman, desiring to obtain some electrical fixtures from the store of the tenant of a building already erected, took a short cut to the rear of the store through a building in course of construction belonging to the same owner. It was dark and he had no light. He fell into a furnace pit and was injured, and sued the owner and the contractor for damages. It was held by the Washington Supreme Court that he was a technical trespasser, or at best merely a licensee with no business there either of his own or of another. He had no invitation to go upon the premises. His own negligence was the proximate cause of his injury, and he took the risk of the attending peril. Invitation, as distinguished from mere license, is implied by law only when the visitor comes for some purpose connected with the business in which the owner or occupant is there engaged, or which he permits there to be carried on, and there must be some real or supposed mutuality of interest in the subject to which the visitor's business relates.—*Gasch vs. Rounds* (Wash.), 160 Pac. 962.

DISCHARGE OF SURETY.

The Pennsylvania Supreme Court holds that a bonding company as surety on a bond is not discharged merely because the bond was executed before the contract where it is not shown that the financial condition of the principal became worse by the time of the execution of the contract, or that the surety sustained any loss from the delay.—*Butz & Clader vs. United States Metal Products Co.* (Pa.), 99 Atl. 169.

REGULATION OF GARAGE BUILDING.

The Delaware Court of Chancery holds that an ordinance prohibiting the erection of a public garage in the residence por-

tion of the city of Wilmington without the consent of the owners of the adjoining lands is invalid as an unreasonable, not uniform and unwarrantable delegation of the power to make building regulations as an exercise of the police power granted by the city charter which must be exercised by the legislative branch and cannot be delegated to any individual. The granting of the building permit was attempted to be made dependent on the consent of the adjoining owners, and so whether in a particular case there was any prohibitory ordinance would depend on the will of such adjoining owners.—*Dangel vs. Williams* (Del.) 99 Atl. 84.

SURETY'S LIABILITY—ADVANCE PAYMENTS.

In an action by an owner on the contractor's surety bond the defense was that there was a material prejudicial departure from the contract by the owner's act in giving the contractor two negotiable notes in advance payment. It is well settled that any material, substantial, and prejudicial variation in the terms of a contract, where performance by the contractor is insured by a surety, will discharge the surety, and that advance payments not provided for in the contract constitute such a variation, as thereby the contractor's interest in performing his agreement is lessened and the surety has a right to the benefit of such interest and is entitled to rely thereon. But even advance payments will not discharge the surety if it affirmatively appears that, under all the circumstances, the departure from the agreement was immaterial and nonprejudicial. The principle must be kept in mind that a surety is so discharged only when the departure is material and prejudicial and not otherwise.

The owner agreed in the contract to give the contractor two promissory notes, payable at a fixed date, for \$5,000 each, when the first floor stores were ready for occupancy. The Wisconsin Supreme Court holds that, as the evident purpose was to aid the contractor in obtaining money to enable him to carry out his contract, the giving of the notes in negotiable form was not a departure from the contract amounting to an advance payment prejudicial to the contractor's surety, discharging the latter, since the only way that the purpose of the agreement could be efficiently accomplished was by giving negotiable notes. The notes were given a short time before the stores were ready. It is held that this was not a material prejudicial departure from the contract discharging the surety.

It was expressly stipulated in the contract that the contractor, at the owner's election, should take \$13,000 in notes, for \$500 each, due three months after a fixed date in payment of the two previously given notes for \$5,000 and the last instalment due on the contract. The contractor thus, in effect, agreed to loan the owner \$13,000 to make this payment. He rendered himself incapable of doing so by putting the two notes previously given by the owner beyond his control, thus compelling the owner in the end to pay them in cash, and by permitting liens on the building aggregating more than the \$3,000 last payment, which the owner was compelled to provide for. The contractor's surety was held liable for damages to the owner on account of the contractor's failure to loan the \$13,000. The damages were such as should have been reasonably in contemplation by both parties when the agreement was made as a probable result of its breach.—*Lloyd Inv. Co. vs. Illinois Surety Co.* (Wis.), 160 N. W. 58.

RIGHT TO MECHANIC'S LIENS.

The Kansas Supreme Court holds that notes taken for building material cannot, in the absence of a materialman's lien, be made a lien on the premises.—*Do Soto State Bank vs. Randall* (Kan.), 160 Pac. 207.

CONSTRUCTION OF BUILDING CONTRACT ON CONTRACTOR'S BANKRUPTCY.

A New Jersey building contract contained the following provisions:

"Fourth. Should the contractor at any time during the progress of said work refuse or neglect to supply a sufficiency of materials or workmen, the owner shall have power to provide materials and workmen, after three days' notice in writing being given to finish the said work, and the expense shall be deducted from the amount of the contract."

"Ninth. All work and materials delivered on the premises to form part of the works are to be considered the property of the owner and are not to be removed without his consent, but the contractor shall have the right to remove all surplus materials after the completion of the work."

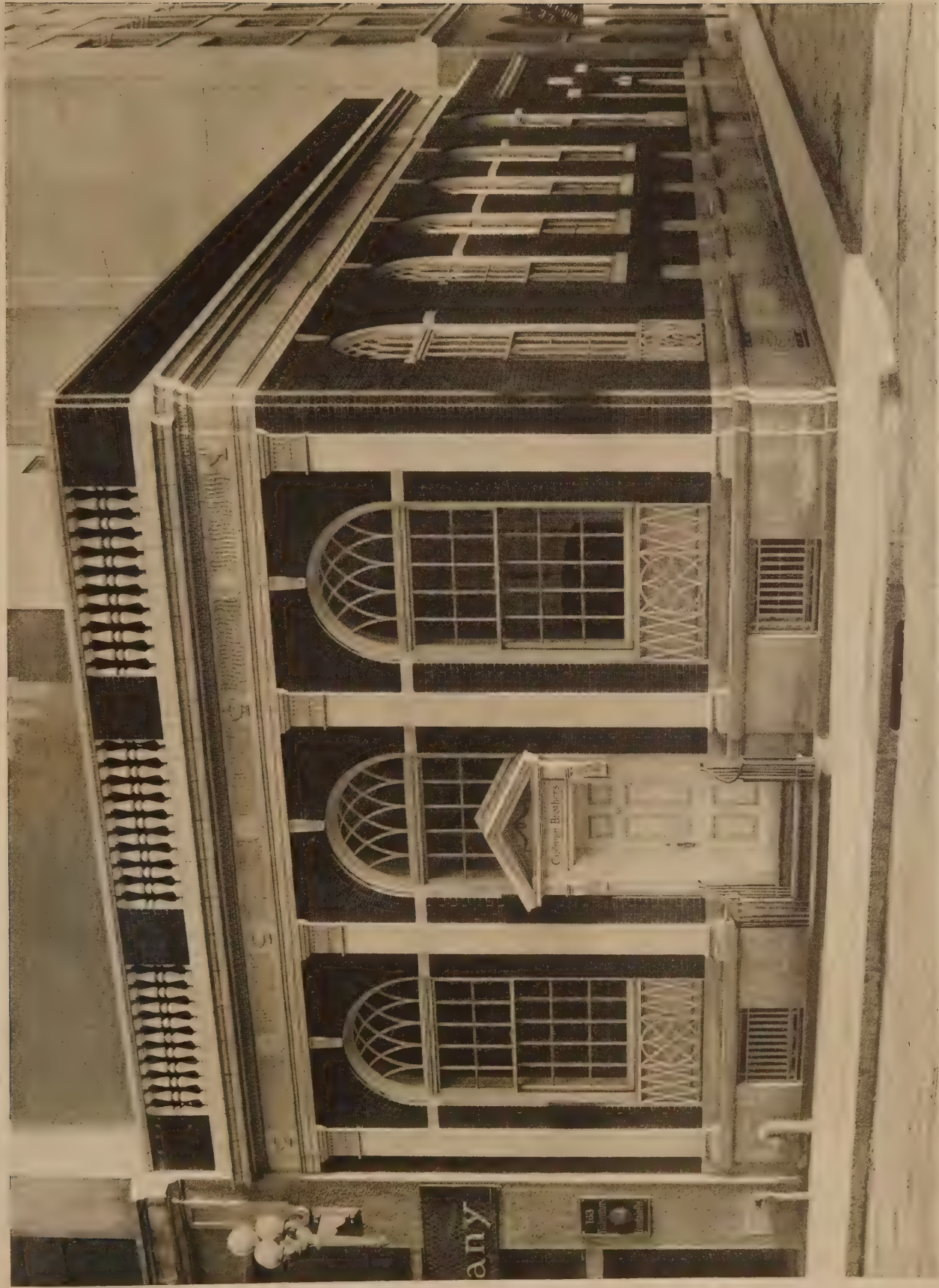
These provisions are common in building contracts made in New Jersey and are intended for the protection of the owner. The contractor ceased work and became bankrupt. The Federal District Court, New Jersey, holds that under the quoted provisions of the contract, his trustee was not entitled to unused materials then on the premises, although having the status of a creditor, with an execution or lien given him by section 47a (2) of the Bankrupt Act, as amended by section 8 of the Act of 1910. The owner had the right to use such material in completing the building, being liable to the trustee only for whatever, if anything, remained due on the contract price after deducting the expense incurred in addition to such material. The Court distinguished the case of *Titusville Iron Co. vs. City of New York*, 207 N. Y. 203, the case principally relied on by the contractor's trustee, the contract in that case between the owner and builder being radically different in respect to the rights of the contractor. It provided that the expense incurred in the completion of the contract "shall be a charge against the contractor, who shall pay to the party of the first part (the city) the excess thereof, if any, over and above the unpaid balance of the amount to be paid under this contract; and the contractor shall have no claim or demand to such unpaid balance, or by reason of the nonpayment thereof to him, and shall forfeit all claim to any moneys retained.—*In re Shelley*, 235 Fed. 311.

SUBCONTRACTORS' LIENS.

Where the architect contracted to build a house at a fixed figure, with a provision that if it cost less than that amount, with 10 per cent. commission added, the owner was to have the difference, and that the owner was to have copies of all subcontracts let, and upon completion an itemized statement of the cost of the work, the owner was charged with notice of the subcontracts so as to entitle the subcontractors to their liens.—*Witt vs. Gilmour*, 158 N. Y. Supp. 41.

DEFINITION OF "PORCH."

The Pennsylvania Superior Court holds that a structure erected along the front of a city residence, not covering the doorway, five feet in height, balustraded in the front and at the ends, and extending five feet two inches from the front wall, is a "porch" within the meaning of a city ordinance passed in 1865 which permitted a "porch, cellar door or step" to extend six feet into the street, where it appears that prior to the ordinance and afterwards, such structures were commonly known in the city and vicinity as "porches," and that many of them were erected after the date of the ordinance without objection by the municipal authorities. In such a case the Court will not apply the technical or architectural definition of a porch as "a covered entrance or open vestibule in connection with a doorway."—*Reading City vs. Yeager*, 62 Pa. Super. 268.



OFFICE BUILDING, CULLMAN BROS., 161 FRONT ST., NEW YORK.

Aymar Embury II, Architect.



ACCOUNTING ROOM, CULLMAN BROS. 161 FRONT ST., NEW YORK.

Aymar Embury II, Architect.



DETAIL. DOORWAY, OFFICES, CULLMAN BROS., 161 FRONT ST., NEW YORK,

Aymer Embury II, Architect.



FEBRUARY, 1917.



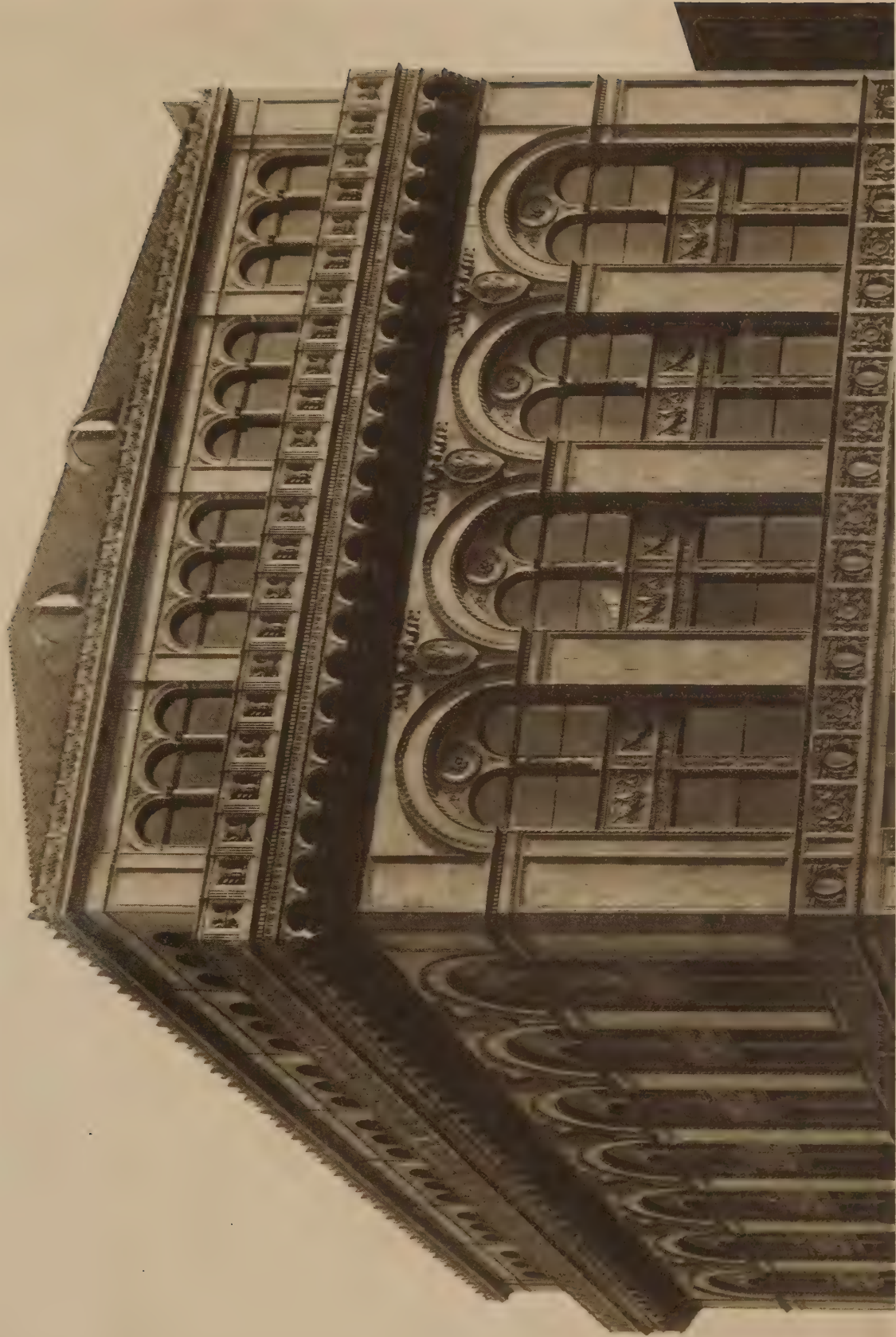
HOUSE AND PLANS, JAS. A. WILSON, ENGLEWOOD, N. J.

Aymar Embury II, Architect.



DETAIL, POSTAL LIFE BUILDING, FIFTH AVE. AND 43D ST. NEW YORK.

York & Sawyer Architects



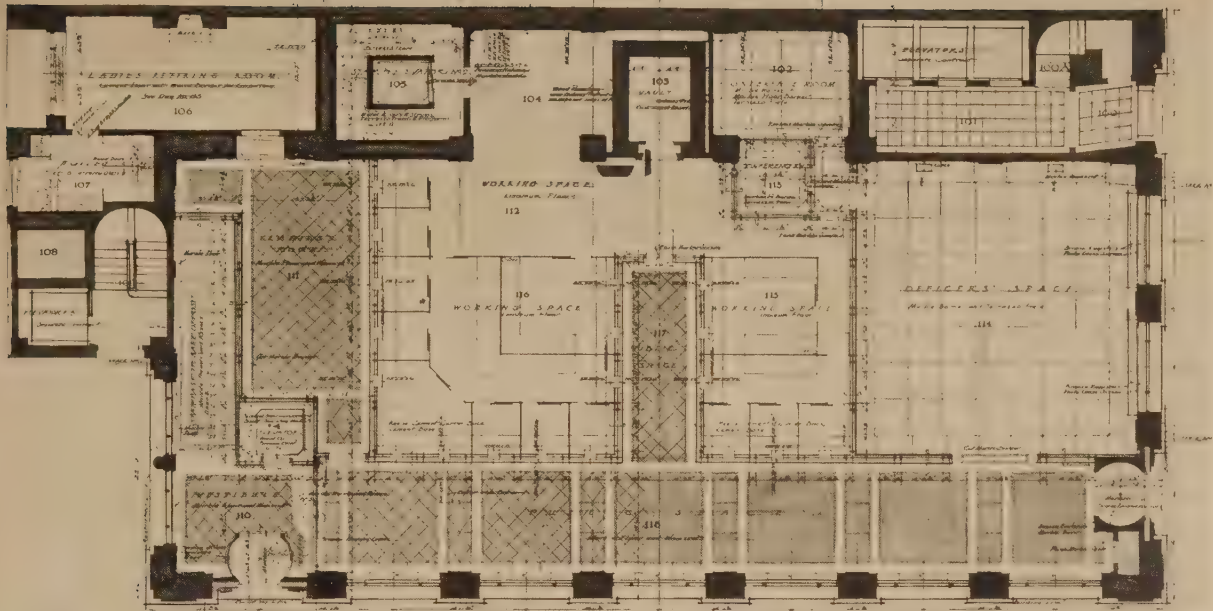
DETAIL, POSTAL LIFE BUILDING, FIFTH AVE. AND 43D ST., NEW YORK.

York & Sawyer, Architects.

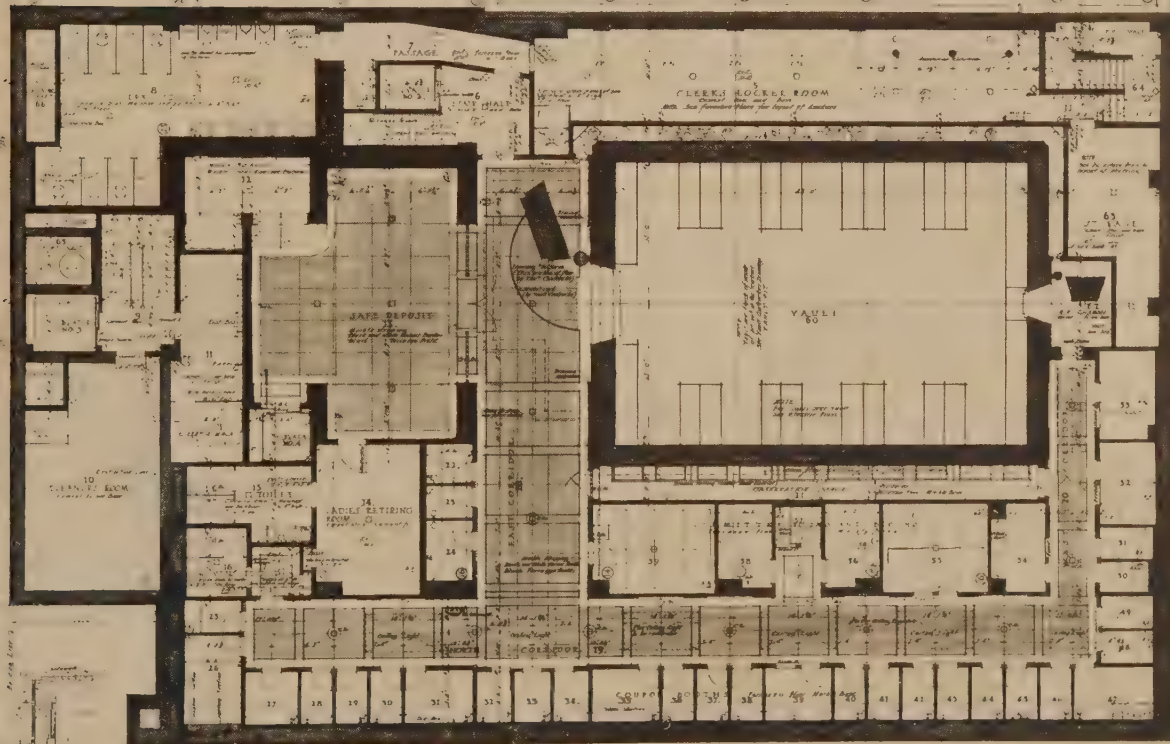


BANKING ROOM, GUARANTY TRUST CO., FIFTH AVE. AND 43D ST., NEW YORK.

York & Sawyer, Architects.



FIRST FLOOR PLAN
Reproduced at $\frac{1}{8}$ -inch scale



SECOND FLOOR PLAN
Reproduced at $\frac{1}{8}$ -inch scale

The above plans show the arrangement of the floors occupied by the Fifth Avenue Branch of the Guaranty Trust Company and the Guaranty Safe Deposit Company

POSTAL LIFE BUILDING, 43D STREET AND FIFTH AVENUE, NEW YORK, N. Y.

YORK & SAWYER, ARCHITECTS

CUTTER TRAC. CUTS WALL
Showing Another Section of Building



CHALIF NORMAL SCHOOL OF DANCING, 163 WEST 57TH ST., NEW YORK.
Geo. A. & Henry Boehm, Architects.



THE KNICKERBOCKER COUNTRY CLUB, TENAFLY, N. J.

Aymar Embury II, Architect.



ASSEMBLY ROOM, THE KNICKERBOCKER COUNTRY CLUB, TENAFLY, N. J.

Aymar Embury II, Architect.

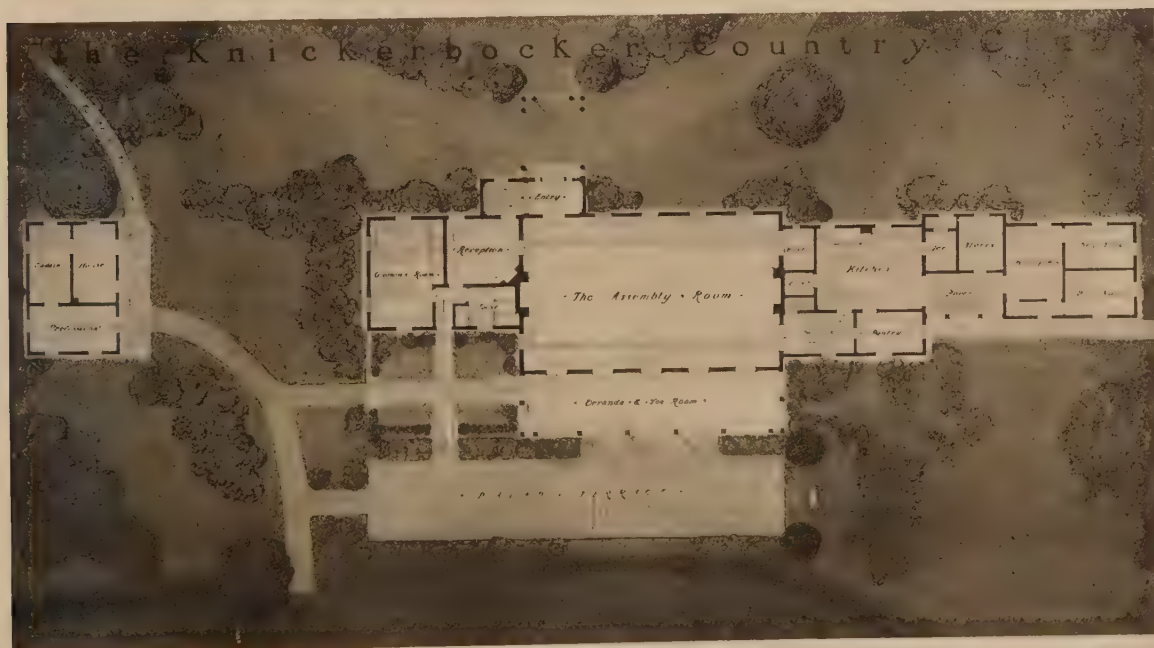


CAFÉ, THE KNICKERBOCKER COUNTRY CLUB, TENAFLY, N. J.

Aymar Embury II, Architect.

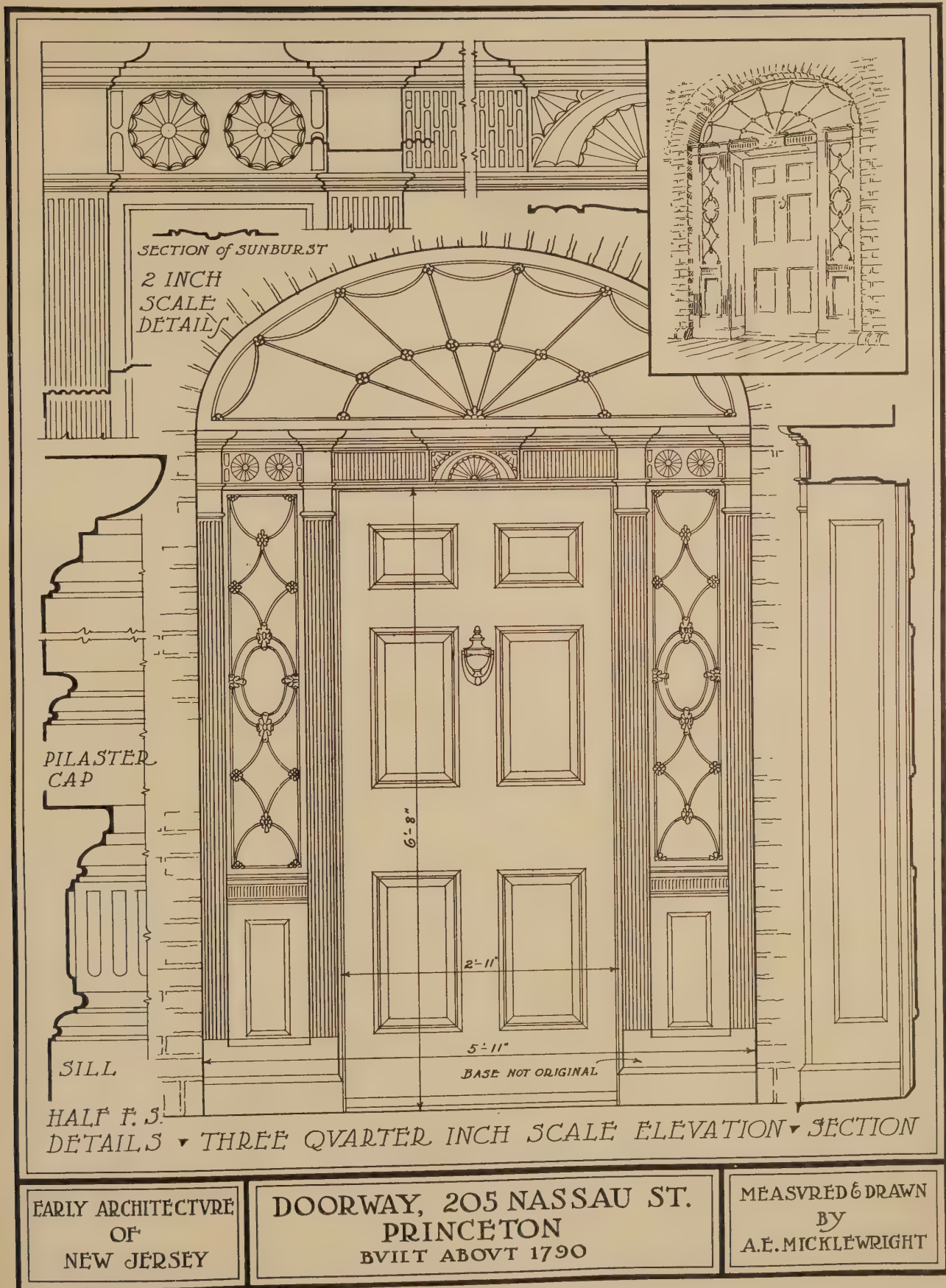


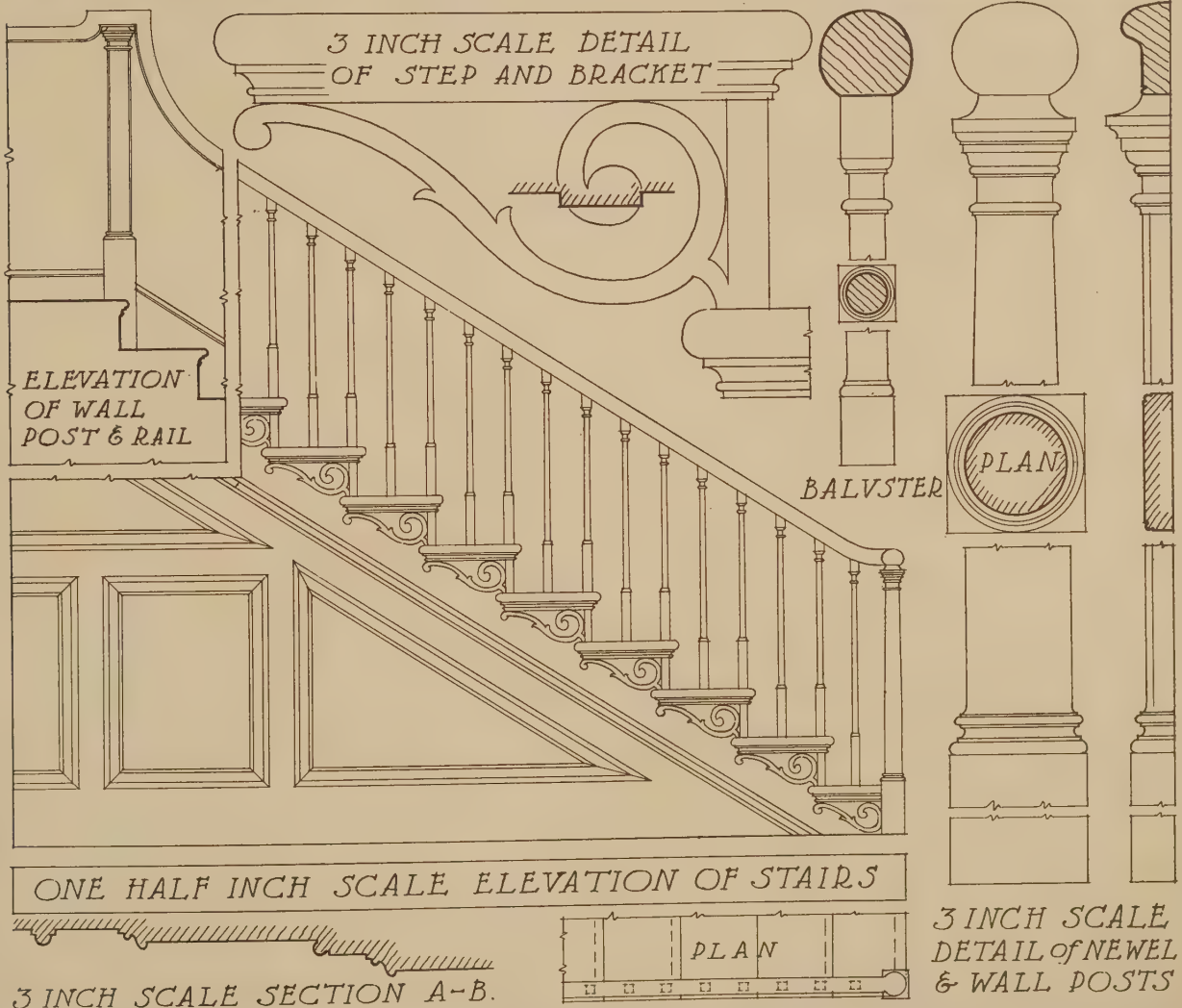
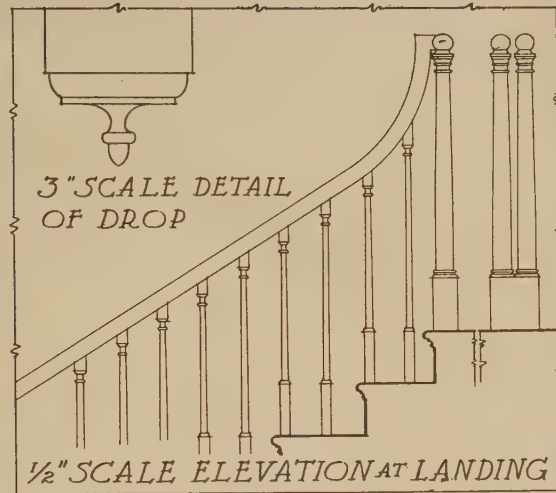
Caddies' House.



Plan.
THE KNICKERBOCKER COUNTRY CLUB, TENAFLY, N. J.

Aymar Embury II, Architect.





EARLY ARCHITECTURE
OF
NEW JERSEY

STAIRWAY OF THE
WOODRUFF HOUSE TRENTON N.J.
BUILT IN 1788

MEASURED & DRAWN
BY
A.E. MICKLEWRIGHT

ARCHITECTURE

THE PROFESSIONAL ARCHITECTURAL MONTHLY

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Measured and Drawn by Walter McQuade.

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Held at Tokio, Japan.

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Editorial

The Architectural Draughtsman—What Does the Graduate from an Architectural School Expect?—The Business Instinct

Editor, ARCHITECTURE,

Dear Sir:

As suggested, I will outline the merits or demerits of an association for architectural draughtsmen. I am very glad to do this, as I believe that such an association would mean a big step forward for the draughtsmen, would prove a much needed help to the architects, and in view of the age, education and real worth of many men who would be eligible to the association, such a body could have an influence for good far beyond the boundaries of its own welfare.

In writing down the things which an association of draughtsmen could accomplish, I feel my inability to cover the subject as it should be. Probably every thoughtful worker in an architect's office could mention many things not included in this letter but just as important as those which are included. This letter can be taken only as suggestive of the really great work which this association could perform.

As to the possible character and membership of such a body, we might suppose that in order for it to be representative of the highest ideals of the profession, its membership should include only those who live up to these ideals; and that it might be able to conceive and accomplish things that will help

to move forward our architecture and its practice, it should be composed of men who have completed their apprenticeship in the profession. I might say that ten years' experience (including schooling) should be one of the requirements for membership. Such an association might be more appropriately called an "association of junior architects."

As to the things which this association might accomplish, the most important is to lead the draughtsman to find himself as a potent factor in the making of the architecture of this country, and as such to assume the responsibility and dignity which belong to him. He has had a hand in all the architecture we have; he is entirely and directly responsible for much that is best in it; his genius and knowledge have helped to make the reputation of many of our best known architects; and by reason of the way in which he carries the digested knowledge of one office to that of another, and then carrying what he has gained by this contact to another and another, quietly, unconsciously, he is exerting probably a greater influence for the betterment of our architecture than any other single factor. With a full realization of what he is accomplishing and a consciousness of the responsibility that he must carry into the future much will have been done to conserve the ambition

and enthusiasm of the draughtsman which is so vital to his own and to the boss's success.

Then there is a great need by both architects and draughtsmen of a sort of employment bureau. This could be installed as a permanent and self-supporting institution in the association. Every draughtsman, the embryo and all, should have the privilege of receiving its benefits. Here the draughtsman could select the position he thought best suited to him, and the architect would have the opportunity of a greater choice. By making it possible to obtain positions more quickly, the draughtsman would save money and his peace of mind, and the architect would feel freer about letting men go when the work got low. The fear of being discharged, which is with every draughtsman who has responsibilities, which hampers him in his work, and often prevents him from expressing his own individuality in a slavish desire to please the boss; this fear would be lessened by reason of the service which the employment bureau could render and, as a result, an architect would get more and better service from his men.

The association could do a much needed service by attempting solutions of such questions as: How to better the relations between architects and the men; the salary question; the opportunities, or the seeming lack of them, for the draughtsmen; why so many men leave the profession. Perhaps there are no solutions, but at least there is much that could be said on such subjects. It is possible that when the draughtsman registers his regular kick about architecture and architects, he says too much, and says it too strongly; possibly he does not say enough. What he needs is an opportunity to get a sane and healthy view of the situation. How better to afford him this than by a general discussion of these things, by a thinking serious body of his co-workers. Discussion and a general interest in things concerning the profession, would also tend to so broaden the ideas of the younger men that they would become more capable of entering the field independently, and when, after having impressed the association with his ability to practice for himself, a member should decide to take the step, the association could prove its usefulness again by assisting him until he had found his footing.

The successful architect's office, as a large efficient organization, is, without a doubt, here to stay, and perhaps to develop into a still larger one. To handle the work of such offices requires in the main men of broad education and sympathy, and a high type of executive or artistic ability. It should be part of the program of this association to raise the appreciation of these men and their work in the eyes of the world, so that people may learn that it is the importance and excellence of a man's work by which he should be measured, and not upon the fact of his being or not being in business for himself.

We workers in the profession, architects and draughtsmen alike, want to succeed, to do something which will be creditable and to which the world will accord recognition. As individuals, few of us have the many qualities and in the proper measure to achieve success alone; we depend on others for qualities which we do not ourselves possess. By working in harmony all may succeed. As architects and draughtsmen, we lean upon each other in the same way and in equal measure. A broader and more forceful recognition of this fact will go a long way to solve the problems which now beset us, and will make for better architects, better draughtsmen and a better architecture. To bring this about is, in short, the service that this association could perform.

Yours very truly,

New York.

VICTOR EBERHARD.

WHEN a man has put in four years at a school of architecture working as he is now compelled to work at all the better schools before he can secure his diploma, he must inevitably feel that he has acquired something which is of ready market value, and he naturally expects that his training is more or less completed and that the time has come when he can put into practice the precepts which he has acquired through years of study under capable instructors. He usually expects too much—although this attitude of mind is not of late as prevalent as it once was, because the better architectural schools have made it a requisite to graduation that a man shall, during his summer vacations, spend some of his time at least, in an architect's office engaged in active practice; and he has there learned how wide a gulf separates the theory from its application and has some faint realization that his training has only begun.

The problem of the architectural school is two-fold. First it must impart to its students the underlying principles of design and such mathematics as are necessary to solve the problems of an architect, beside giving him a mastery over the implements of his trade and imparting to him that general culture which is almost a necessity in the architectural profession. This can be done without at all solving the second problem, which is to fit a man to earn \$15.00 a week.

The constant complaint which the architects make of the schools of architecture is that men come from them untrained and without even the knowledge that they are untrained. So they are, yet they have acquired during the four years of college work a knowledge of architectural history and of the sources upon which we draw for current design, and a general cultural training which they can obtain only with the utmost difficulty by any other means. It would not be difficult in six months or even a year, of intensive practical experience for a man to acquire sufficient knowledge of structure to enable him to make full sized details rapidly and practically correct, and during that six months or a year, he might be taught enough drawing to enable him to make a fairly respectable one-quarter inch or half-inch scale elevation, or to figure a plan. These things he is not taught until he completes his college course and goes to work in an office. It is pathetic to find the college graduate in architecture, even a man who has done some summer work in architects' offices, lamentably ignorant of what are very simple problems to the draughtsmen whose training began as office boys and have had to acquire their knowledge from the draughtsmen who were their seniors in the offices. The college trained men cannot be too highly commended for the intelligent way in which they readjust themselves to the new order of things, when they find themselves no longer seniors of the university, but freshmen in the school of life.

The graduate from an architectural school finds that his knowledge is rarely of great present benefit to him. He has got to learn a number of other things before he is of real utility to his employer, even though his skill as a draftsman be considerable, because no employing architect will permit the youngest man in his office to make the sketches and it is only the sketches which a college training fits a man to make. Certain graduates of unusual skill in rendering find themselves in demand for completing competition drawings, although they are rarely permitted either to lay out the plans or to develop the façades. They are used as mechanics to dress up another man's ideas. For other graduates with less ability as draughtsmen there is only one position open; they must begin to learn something about practical office work—the making of the quarter scale figured drawings, full sizes and other necessary details. Yet in the end, their position is perhaps better than that of the man whose more technically skillful work is of greater imme-

diate interest, but which does not contain the essential schooling through which a man must pass before he can begin to practice for himself. It is a thing which is little realized that the skillful draughtsman is not necessarily a skillful architect, and, while certain of our celebrated practitioners of architecture—Messrs. Swartwout, Magonigle and Hornbostel, for example—can, and sometimes do make lovely renderings, either of perspectives or of elevations, others of our architects, no less distinguished, have but the slightest possible ability as draughtsmen and must employ other men to make their drawings pretty, so that they may obtain the work which they themselves know how to construct; but it must never be forgotten that the drawings of an architect are not like paintings—things to be made for their own sake—but are mere explanations of how a structure should be put together. It is probable that far too much stress is laid upon beauty of drawing in our colleges, to the exclusion of the much more important development of ability in design.

The college man, when he graduates from the architectural schools, expects that he has nothing more to learn about the orders, but he finds in practice that he must unlearn much of what he has acquired. Training in orders must begin somewhere, and probably Vignola is as good a primer as can be used, but it is, after all, only a primer. No architect of real ability uses the orders in the proportions in which they are found in the books and the first thing a man has to learn after he graduates is that the muticle is not inseparable from the Doric order and that there is no Median law governing the proportion of length to diameter of the column.

Of course, some college men may graduate with a feeling that they know all about architecture and certain college men who, because of influential friends, may begin practice without office training, can muddle through somehow, learning through their failures and eventually achieving success, but the average college man upon his graduation, is really a much more humble person than he appears. He has had a little while in offices to teach him of how little worth in dollars his knowledge is at the moment, but he has also learned that what he has been taught, added to what he can readily acquire, will make him a capable architect, so far as such a thing is possible. Architecture is, thank God, sufficiently an art so that real quality cannot be taught and must be inborn, and the best the architectural school can do is to drill into its students a knowledge of what is distinctly wrong, rather than instruct them in what is absolutely right; it can keep their work from being atrocious, but it cannot lift it above mediocrity unless the ability is there to begin with.

THE business instinct is as important to an architect as it is to a cloak and suit manufacturer. Business is compounded of two separate elements: the production and the sale of the goods, but architecture differs from most businesses in reversing the order of these two processes; most things are manufactured first and sold afterwards, while the architect sells his work first and later manufactures it. It is very apparent that it is harder to sell something which you have not got, than something which you have, and good salesmanship is almost a primary requisite of the architect.

There have been many books written about salesmanship and apparently the principles which make a salesman successful are the same whether he is selling life insurance, groceries, or architecture—he must convince the purchaser of two things, or perhaps they may be better described as two aspects of the same thing; first that the quality is good, second that the price is moderate. It is well known that certain staple brands of groceries command higher prices than the same quantities of other goods and that each is good value. So in selling life insur-

ance, the premium on a term policy is much lower than on a twenty-payment life, but both represent real value. Likewise, in selling the services of an architect; the customer, in this case the client, must be convinced, first that the architect's services are worth having, and second that the price asked for them is not too high. For the services of certain men there is no price people would consider exorbitant, although public sentiment in this respect does not tolerate such great differences as obtain in the value of paintings by different men—a canvas, for example, 30" × 40" costing \$1,200 if the paint is applied by Gifford Beal, and \$12 if applied by some department store window artist. In selling his work, therefore, the architect has two talking points: its quality, and its price, and since the lowest price at which an architect can properly design work is fixed by custom, it is less a question of how little a man can work for than it is how much he can get, the position of the architect in this respect resembling somewhat that of the lawyer or doctor.

The second essential in successful business is the production, and real business instinct is as necessary to the architect as it is to the manufacturer. He must, in the first place, do his work properly regardless of the cost and, in the second place, he must do his work as cheaply as he can with regard to quality. The question of cheapness of production is dependent mainly upon two things, the ability of his draftsmen and his own ability to know how to produce the effects he desires so that there may be no time lost in study and re-study of the problem. This is an item of the utmost importance. The work of the architect costs enough if it is only done once; if the same thing is done over several times it is a foolish waste and if an architect is to make a living out of this business he can do it only by charging commission enough to permit him to study and re-study, or by determining pretty precisely what he wants without making drawings of the same thing over and over again.

To many men the business of architecture seems to reduce itself to a question of bookkeeping and they feel that they are being businesslike architects if they know that their books are properly kept, so that they may be able to render accurate statements to their clients; to be adequately advised of the extras and allowances on any piece of work and to be able to show where the last penny was expended on any job. Now these things are all necessary, but they are not in the proper sense, important parts of the business of an architect, nor are they in themselves an indication that the architect has business instinct.

Business instinct is perhaps best exhibited when an architect realizes completely the mean that his client desires to obtain between the best at any cost, and the lowest priced goods which may possibly serve. He must adequately gauge his client's attitude of mind as regards quality and expense, not using cast cement or terra cotta when marble alone will be satisfactory to him, and not using marble when its cost will be a cause for dissatisfaction.

Bookkeeping is one thing; business is another, and the business of an architect is very much more than mere bookkeeping or systematizing of an office.

A FIRM of architects in Paris has completed a somewhat fantastic seven-story apartment house, which is claimed to embody all the advantages of hillside dwelling—light, air, and a good view—even on a comparatively narrow street. This *maison à gradins*, or "house of steps," stands on the Rue Vavin. Each floor is set back several feet from the one below, thereby giving the front of the apartment a decided slope.

Each floor above the third is set back some eight feet, and the space thus left open is converted into a balcony

or terrace. By means of an ingenious arrangement of the overhang, the privacy of the occupant below is secured, for, although an unobstructed view of the street is given, the terrace below cannot be seen. In the finished house the terrace has a row of plants along the edge, and the green, viewed from the street, has a most pleasing effect. An ornamental iron railing protects the edge of the terrace and provides an open air playground.

This style of building, if constructed on both sides of the street, will give almost as much light to the lower stories as to the top ones. Actually, the apartment on the Rue Vavin gains an hour more of sunlight a day than do houses of ordinary construction situated on the same side of the same street.

Although the building covers more ground than an ordinary one, the increased cost of land is made up by the increased height to which the building can be raised without interfering with the light of the lower floors or of those across the street. This is especially advantageous in Paris, where the building code does not permit a building on a street, say 27 feet wide, to be more than 50 feet high on the building line. Above this height it must recede. By the plan of Sauvage and Sarazin, the architects of this innovation, ten stories may be built conforming to the spirit and the letter of the law, where only six main and two inferior floors could be constructed under the usual design.

All rooms in the model apartment have direct light either from the street or from the court at the rear. Central heat does away with the innumerable chimneys common to Paris—one for each fireplace in each room—and the architects claim a substantial saving from this one item.

The façade of the building is finished in white-glazed

brick, with a simple and pleasing decorative motive in bright-blue bricks, which well set off the green flower gardens on the terraces. The rooms are painted in quiet colors, and, unlike many French houses, are devoid of plaster decoration, having only a picture molding. This, of course, has reduced the cost of the building, as has also the simple exterior treatment.

Another point of interest is the ownership of the building. The house has been constructed by a company formed of persons who were willing to live together, and each shareholder owns his apartment. This co-operative plan insures each member of the corporation the full or partial ownership of his home, according to the amount invested. For example, if a man has subscribed \$10,000 he will have a reduction in his rent of, say, \$500 a year. He will in reality have his apartment rent free, and also receive a dividend on his investment if the venture proves as profitable as is anticipated.

“WHY,” asks *Printers’ Ink*, “do modern architects assume that U is V, and carve in stone that palpable and bold absurdity? Now that we possess the U, with soft and graceful curve, of unexcelled docility and willingness to serve, why do they carve UNITED STATES and PUBLIC SCHOOL and such, and make the English language look as funny as the Dutch, with RESTAURANT and PULLMAN CAR and UNIVERSITY and other marks of educational perversity? That V impresses us as a cheap and gaudy bluff, which parvenues may pull in place of more substantial stuff, but people who are fashioned out of unpretentious dust view all such affectation with an unassumed disgust. Such exhibitions always make us glum and blue. Now, honest Injun, don’t they have the same effect on you?”

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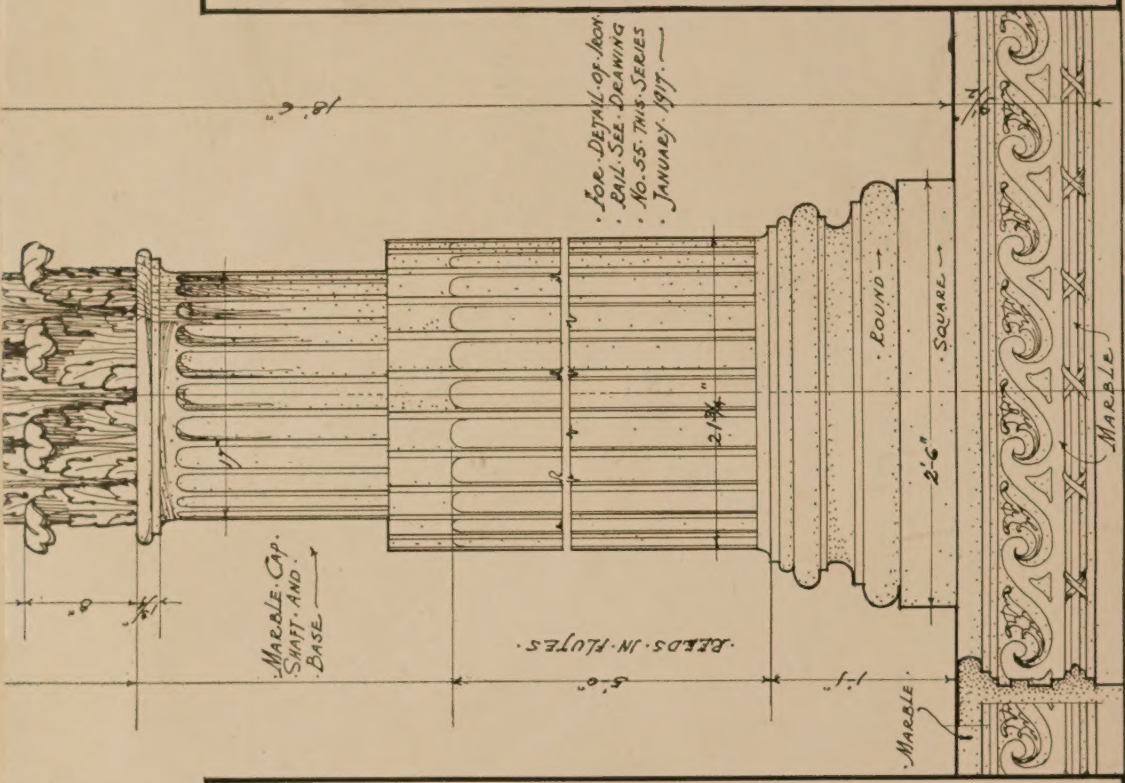
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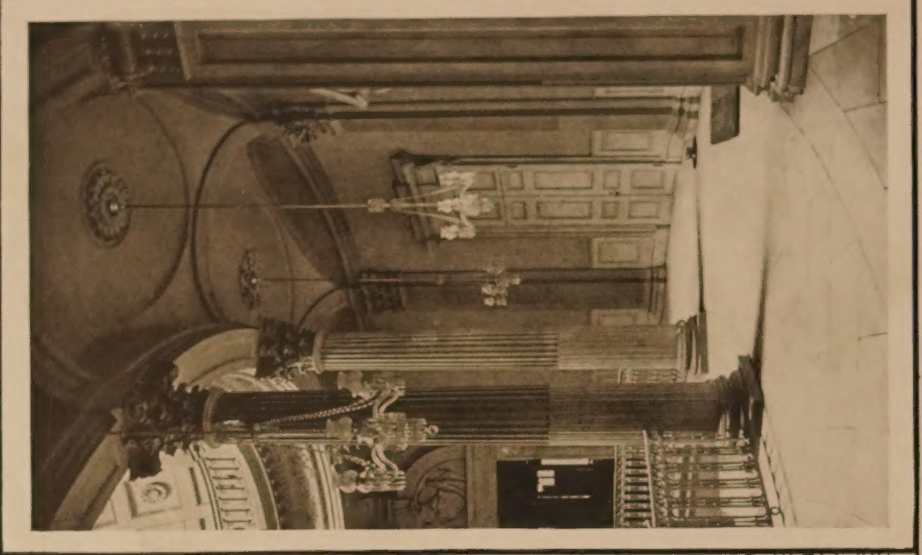
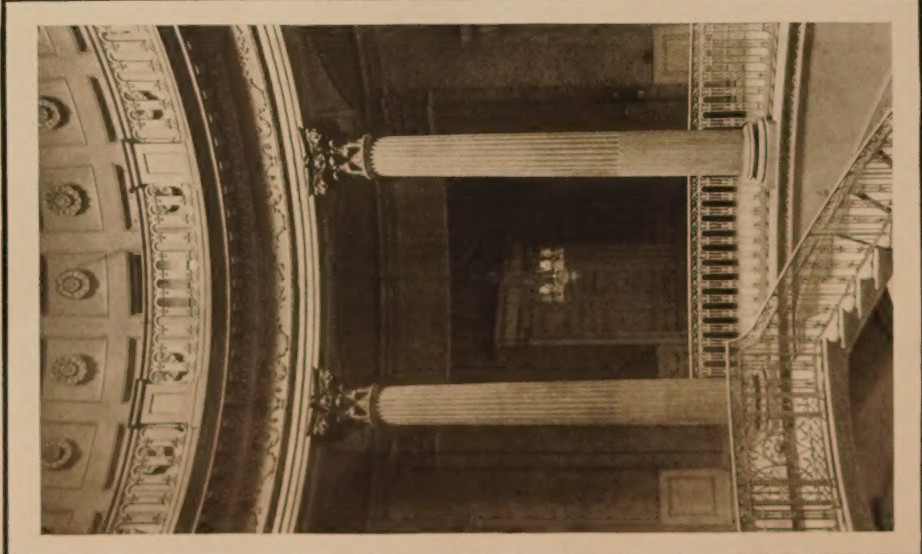
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